# Zoe

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## CONTENTS.

## REVIEWS.



## PROCEEDINGS OF SOCIETIES.



## CONTRIBUTORS.

LIST OF PLATES.

# ZOE

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## FORMS OF TREES AS DETERMINED BY CLIMATIC INFLUENCES.

BY GUSTAV EISEN.

A traveler from the Arctics or from the high wooded mountains, in any district of the world, cannot but be impressed by the different forms which trees and shrubs assume in the respective regions. Nowhere is this difference in form more striking than between the trees inhabiting the pine region of Sierra Nevada and those which grow on the lower plains in the interior valleys.

We have so constantly been accustomed to take things as they are, without inquiring into the causes why they are so, that it seems to us quite natural that the forms of trees of the high mountains should be different from those of the lowlands and valleys. Still this difference is so great and so very apparent that the causes which operate in making up these different forms must be very great and very important ones.

In the high Sierras, for instance, in that region below the snow line, where the pines and spruces dominate, we find that almost every shrub and every tree resembles the other in a general way. The trees are tall and erect, with a central undivided trunk from which the branches slope down towards the ground. The shrubs, again, are low and depressed, spreading out horizontally, forming dishlike masses, hugging the ground instead of seeking the sky. A few thousand feet further down in the region where the evergreen pines and spruces have ceased, the trees as well as the shrubs begin to assume a different aspect. The trees in this region are not so erect, their branches are less sloping, their crowns extend further, the trunks are often branching; there is, in fact, a decided difference in their general form. The shrubs, again, are more erect and bushy, forming often dense masses, which show little or no tendency to flatten out.

If we again follow the vegetation further down to the plains, the change in form is yet more pronounced. The trees are here as a rule branched close to the ground, their crowns are wider and spreading, the branches drooping and often sweeping the ground. The general form, which in the higher Sierras was that of an elongated pyramid, has here changed and become globular. We may call these respectively, the spruce form, and the oak form. In the higher mountains we rarely meet with the oak form, at least not in evergreen trees, and on the plains the spruce form is equally rare. There are some exceptions to this rule, but they are few and in no way interfere with the theory which I will here set forth and endeavor to prove. Before we dwell upon the causes which have been and yet are operating in creating and maintaining these characteristic forms of trees, it is necessary to first consider those causes which combine in affecting a change in the form of trees generally.

Nearly every visitor to the wind-beaten and open seashore has noticed the characteristic forms of trees and shrubs growing there. The shrubs spread close to the ground, the trees lean towards the interior, their crowns spread out horizontally and their branches are thorny and knotty and continually bent. Such a sight is common everywhere in exposed places. In sheltered localities inland these same varieties grow upright, their crowns become less horizontal, the branches less twisted, and the same shrubs, which on the sea shore hug the soil, grow here straight and send out slender branches. Even to the least observant the force that operates here and causes the trees and shrubs to so change their shapes is the wind. When we see such trees and shrubs painted on a canvas, we know at once that the landscape is a wind-beaten one, and that the vegetation is struggling against a force which is trying to destroy its foothold.

But while the wind is especially active on the seashore in changing the natural or perhaps the original form of the trees and shrubs, it is similarly effective to a lesser degree in any locality at all exposed to winds. The interior plains, the cliffs on the sides of the desert, the high mountain peaks, the elevated plateaus, the table mountains, the slopes of the more sheltered sides of islands, in fact everywhere may the power of the wind be perceived.

The effects of the wind may be temporary or permanent; temporary, if the plant regains its original form and outward appearance when removed from the windy region to a sheltered one. This is by

far the most common effect and especially refers to shrubs. Many instances may be cited, but I will only mention one. *Baccharis pilularis*, which grows everywhere on the coast around San Francisco, clings typically to the soil and sandhills where exposed to the wind, while on the north side of Tamalpais, where the shelter is perfect and even in the oak scrub of Golden Gate Park, it assumes an erect form. So different is the outward appearance between these two forms, that the former has been described as a distinct species, *B. consanguinea*.

Similarly on nearly all our high mountain tops we meet with scrub-pines growing in the crevices and clinging to the rocks like real coverlets of verdure. But the same species may be found further down in the elevated valleys growing erect with sloping branches and undivided trunks. Such instances are common. I may, however, here especially recall the dwarf and scrubby *Pinus monticola* growing in the cañons on the slope of Mount Dana, while further down splendid specimens are crowding the sheltered meadows.

As an instance, again, where the effects of the wind have been partly permanent we may point to the Monterey pine *(Pinus insignis)* and to the Monterey cypress *(Cupressus macrocarpa)*. Mature specimens of these varieties assume always horizontal crowns, even when growing inland, and only during their earlier growth do they show a tendency to grow erect like most species of pines or coniferous trees generally. We may presume that if the evolution of a species is accompanied by this continued wind force, the latter will to a great degree mould the outward form of the species. If again the evolution of a species takes place under various conditions of wind and calm, the form of the species will be variable according to exposure.

The effect of the wind while apparent everywhere and while found in every climate and in every country is, however, not the most powerful agent in shaping the forms of trees and shrubs. The snow which part of the year covers vast territories, often to a depth of thirty or more feet, has a great influence upon the forms of all plants which are exposed to it for a longer or shorter time.

As the effects of the snow depend chiefly upon the resistance to pressure, it will be seen that evergreen and deciduous trees must be unequally affected. The foliage of the evergreens offers much more resistance to the snow than do the bare limbs of trees and shrubs

which during the winter season are void of leaves. In some horticultural districts, where snow but seldom falls, and where accordingly such trees as olives, oranges and lemons are cultivated successfully, an occasional fall of snow may do and has in many instances done considerable harm. We know that when the snow lodges on the evergreen and upright limbs of orange trees, these limbs become so heavy that they break down, more or less ruining the trees. On such occasions the growers hurry through their orchards shaking off the snow before it begins to melt and become heavy, thus freeing the limbs of the trees from the burden that would injure them. The cause of the mischief is thus not alone to be found in the snow, but also in the upright shape of the limbs and trunks of the trees. Those limbs which point upwards do not yield readily under the pressure of the snow, and trunks which are repeatedly forked, will, if the pressure is heavy enough, split lengthwise. In case the trees in question had possessed downward sloping limbs and an upright, undivided or standard trunk, the effect of the snow pressure would have been less dangerous; the limbs would have yielded to their snow burden, which, when melting, would have slipped off, leaving the limbs free, and the undivided trunks would not have split, and the trees would have escaped without injury. If such snowfalls were frequent and regular, only such varieties could be cultivated as were possessed of downward sloping limbs and upright trunks. All trees shaped otherwise would gradually be ruined and their cultivation become impossible. These last remarks refer only, or at least principally, to evergreen trees. If the orange trees, which we gave as an example, instead of being evergreens were deciduous, that is, presenting only bare limbs in the winter, like peaches, apricots and pears, the pressure of the snow would not have injured them, at least not by breaking their limbs and splitting their trunks, and their cultivation would not necessarily have been abandoned. If we consider a forest, instead of a horticultural district, we will find that the conditions are there very much the same. The yearly snowfall, if only heavy enough, tends to break down and destroy all wild evergreen trees, which do not possess a form suitable to resist the heavy snow mantle. Trees which would thus suffer would be all evergreen trees with spreading crowns, such as live oaks, laurels, madroña, certain pines, such as Monterey pine, digger pine *(Pinus Sabiniana)*, Italian pine *(Pinus*

*Pinaster)*, Lebanon cedar, and the hundreds, if not thousands, of other evergreen trees which inhabit regions below the regular snow line.

Nature thus eliminates from snow-visited forests all evergreen trees which are not suited to resist the pressure of the snow. On the contrary, the snowfall makes it possible for all those trees to live and survive which, through their outward form, are able to easily shed the accumulated snow. As regards deciduous trees, no such upright trunks and sloping branches are necessary, as the bare limbs do not accumulate the snow, nor suffer under pressure. If the above is true, the forests of snow-visited districts will be found to consist of only such varieties of trees as possess the requisite form; that is, evergreen trees with upright, undivided trunks and downward sloping branches, as well as of deciduous trees of various not especially characteristic forms. Upon examination this will also be found to be the case.

A visit to the high pine forests of Sierra Nevada shows us just such forests. Nowhere is the snowfall heavier and nowhere is the characteristic form of the evergreen trees more pronounced. This is also the case in all other show-visited regions where forests are at all able to exist. Where the snowfall is the heaviest and lasts the longest, all evergreen trees, at least during a certain period of their life, possess the required pyramidal form. Evergreen trees of any other form would in their struggle for existence have little or no chance to compete with better equipped neighbors. It follows, also, that the less the snowfall the less characteristic will prove the pyramidal form in all evergreen species, while lower down the mountains on the warmer slopes the pyramidal form may be expected to be entirely absent.

To refer to our nearest high mountains, the Sierra Nevada, we find thus on the snow-belt such trees as *Abies Douglasii*, *Picea amabilis*, *Pinus Lambertiana*, *Libocedrus decurrens*, *Sequoia gigantea*, etc. All these show in a characteristic way the pyramidal form, the snow-shedding branches and the undivided trunk. We find in this region no large live oaks, nor any large evergreen trees of globular or goblet shape. But in the region immediately below the heavy snow belt, the characteristic pyramidal shape is entirely absent. The forms of the evergreen trees are here evidently regulated by other agencies. In this region we meet with several evergreen

oaks with large crowns, spreading branches and repeatedly divided trunks. The pines also, like *P. Sabiniana*, are characterised by their forked trunks, their upright limbs, and by their general resemblance to deciduous trees. As regards shrubs of all kinds, they are hardly less influenced by snowfall. In the snow-visited forests at least, the evergreen shrubs show a low depressed form, sometimes spreading out like dishes on the ground. Other species, again, like the manzanitas, possess repeatedly zig-zag bent limbs especially adapted to resist the pressure of snow and wind. Such zig-zag form is also possessed by the branches of trees, greatly assisting them to resist outside pressure of any kind. Thus while the lower or central branches of most of the pines in the snow region slope downwards, the upper limbs, which are naturally less exposed to snow pressure, assume a horizontal position, but are compensated by being repeatedly bent and furnished with heavy knees. Such limbs are generally seen in the various species of pines, such as *Lambertiana*, *contorta*, *Jeffreyi*, also in *Sequoia gigantea*, etc., while they are almost absent in the spruces and firs, the sloping elastic limbs of which continue to the tops.

### SUNLIGHT AND HEAT.

Another important agency in shaping the forms of trees is the direct sunlight and heat. As the force of the direct rays of the sun is different in different places, it follows that their effect upon trees and shrubs must vary with the locality, as well as with the physiological structure and nature of the plants. Various other agencies, such as the moisture in the air, the force of the wind, the rainfall, dews and fogs, combine with the sunlight and heat, either in decreasing or increasing the effects. It is especially in warm and dry regions where the heat and light are all powerful in modifying and directing the development of the form of a tree or shrub. An excess of heat and light is nearly always hurtful and may even be so injurious as to kill the trees, or make them unfit for the region. It is especially the horticulturist that notes these effects of heat and light. In tender plants the effects are more pronounced and principally of two kinds. The direct rays of the sun injure the stem or trunk on the southwest side, or on the side on which the greatest force of the sun rays are concentrated during or shortly after midday. The tender bark and cambium are scorched, dry up and pre-

vent the sap from circulating. In course of time injurious insects, such as borers of various kinds, find their way through crevices, and parasites gradually destroy the trees. Trees which are thus especially tender are, among cultivated trees, apples and pears, and among wild trees, weeping willows, poplars, young oaks, maples, etc. A tree when once injured seldom recovers if left to itself, but dies or at least becomes sickly. In order to counteract this fatal force of excessive light and heat combined, the horticulturist encourages lower limbs and foliage, prunes his trees low, or otherwise shades the exposed parts. Nature works very much in the same way. Young trees growing in heated regions are covered with lower limbs thickly set with foliage, or develop large weeping tops or crowns with drooping branches, which shelter the tender stems as effectually as if they were covered with an umbrella. That such a shade is absolutely necessary can be clearly demonstrated. There is, for instance, no more tender tree than our common weeping willow, a native of the hot region of Asia Minor. This tree flourishes even in our warmest regions under proper conditions of moisture, as long as its natural form is not interfered with. But let anyone prune back its limbs and cause the direct rays of the hot sun to strike its trunk, and the tree will soon become diseased and die. The dying of weeping willows is common all over the warmer parts of this state, and is everywhere to be principally ascribed to the cutting away of limbs and to the entrance of heat and direct light.

The excessive heat and light has also a bad effect upon the ground in places where rain or other moisture is scarce. The sun dries out the soil and makes it too dry for the trees and plants. To counteract this heat, nature causes lower limbs to spread out as close to the ground as possible, or furnishes the tree with large dense and rounded crowns which cover the soil with shade and prevent the moisture in the immediate vicinity of the trunk and roots from drying out.

Nature furnishes also other remedies, such as peculiar position of the leaves, tough and hardy bark, gray and light colors of leaves and stems, hairs or cells especially constructed to withstand evaporation or heat.

While the snow especially affects evergreens, the heat and light affect evergreens and deciduous trees almost alike.

In the tropics the intense heat develops another tree form, the umbrella form. In this region the heat is always accompanied by moisture, and is thus never excessive or dangerous for trees which naturally seek the light. The moisture and heat combined produce a most vigorous and dense vegetation, the very opposite to what is found in the arid zones. The effort of the tree is therefore concentrated in its endeavor to reach the light and to push out from the dense shade nearer the ground. The most vigorous growing trees in this region send up straight and undivided trunks to a level with the top of the dense undergrowth, branch at this level and form immense umbrella-like crowns above less vigorous trees. This umbrella-form gives to the tropical landscape a distinct and characteristic appearance. A tendency to assume such an umbrella-form can also be recognized among those trees of the temperate zone, which grow in moist places, such as river bottoms, cañons and other sheltered localities—trees in fact, which delight in moisture. But nowhere is the form so pronounced as in the tropics, where it is common with all large species of the denser forests. The uplands of the tropics, where the rainfall is less and where heat and drying winds are more powerful, and where accordingly the vegetation is less dense, the umbrella form is rare, or where it exists is caused by other agencies.

The origin of the tropical umbrella form is therefore not exactly identical with that of the umbrella form assumed by most pines in such districts as the Mediterranean or the gulf region of the United States, and to a certain extent also by a few more northern pines. This umbrella form is caused by the falling off of the lower branches, which never possess the strength of the upper limbs. The umbrella form, however, greatly favors their struggle against wind and heat.

In these drier places in the tropical districts the umbrella form gives place to the globular form, the conditions there being quite similar to what they are in the drier regions further north. Observe, for instance, the form of the ceiba *(Bombax Ceiba)*, which inhabits dryer localities in the Central American tropics. This tree is almost globular in shape, in order that its branches may give necessary shelter to the trunk and to keep away the reflected heat. An effort to change the form of this tree by pruning results fatally, as the branches become sun scalded and a prey to borers which

eventually destroy the tree. In crossing Central America I was especially impressed by these different tree forms, characteristic of different regions. Along the lowlands of the Pacific Coast up to 2,000 to 3,000 feet, the characteristic form of the various strong growing trees was the umbrella form. Above 3,000, and from that altitude towards the interior in the dry and warm district the globular form predominates. As we ascend the interior highlands in the vicinity of Coban the climate suddenly changes and becomes very moist. With this change comes also a change in the form of the trees which here assume the regular umbrella form. The same climate continues uninterrupted to the Atlantic Coast, and the district is characterized throughout by the predominating umbrella form.

All trees require more protection when young, and this explains why young trees are shaped differently from older trees. Thus the form of a young specimen of the common blue gum *(Eucalyptus)* is well known. While young the tree is pyramidal and the sloping branches are covered by horizontally extended leaves. No form can be more adapted to withstand heavy winds. As the tree grows older, the stem stronger, and the roots penetrate deeper, this original form is not required any more, and the tree assumes a semi umbrella-like crown.

If we consider the principal forms of trees in their connection with influences of wind, snow, rain, sunshine and heat, we find that the various forms may be grouped principally under the following heads:

A. The upright form, with a central undivided trunk and with downward sloping branches. This form is possessed by most conifers inhabiting snow-visited regions. The downward slope of the branches facilitates the shedding of the snow, while the undivided trunk offers less resistance to heavy loads of snow. Forked or branched trunks would split or break.

This form may be either necessary to the species, as when the latter is confined to snow-visited districts (example *Picea amabilis)*, or it may be inherited and continue as a characteristic of the species which grows in a warmer climate, but which evidently had been evolved from a species which once inhabited colder regions. Example: the redwood *(Sequoia sempervirens)*, Lawson cypress *(Cupressus Lawsoniana)*, and many other evergreen trees inhabiting

the moist, snowless climate of the Pacific Coast north of San Francisco.

B. The upright form with erect or horizontal branches. The upright trunk in this form must be considered as inherited from ancestors where it was a necessity. Later on the sloping branches gradually assumed a horizontal position. Example: most species of cypress, yew, juniper, etc., of a more southern origin. It is interesting to note the form of *Cedrus Deodara* or Himalaya cedar. This tree, growing in regions of Himalaya where heavy snowfalls are not unfrequent, possesses while young characteristically downward sloping branches. *Cedrus Libani*, Lebanon cedar, which is only a form of *C. Deodara*, possesses no such sloping branches, but horizontal branches, evidently developed in a climate where the absence of heavy snow has made the downward slope of the branches unnecessary. Most species of juniper possess erect branches, as would be expected in a genus which finds its most congenial home and greatest development in the warmer regions of the Mediterranean where snow is almost unknown.

One species (*Juniperus communis*), however, which is common in Northern Europe, is distinguished by a very different form from the southern species, being dwarfed, prostrate, and repeatedly branched. But that this form of the European juniper is not the natural one, can be seen by the fact that whenever this species is transferred to snowless localities it at once assumes the upright form, growing as straight and slender as a southern cypress. Similarly we find this upright form possessed by all specimens of this juniper which grow in close proximity to smelting works, where the heat is strong enough to melt the snow. The different appearance of this juniper in such localities is really most startling.

Pines which inhabit snow-visited regions are as a rule very upright, with downward sloping branches, while the southern pines, both in Europe and North America, as well as in Central America and Mexico, have branches which either spread horizontally or which stand erect. Compare, for instance, *P. Lambertiana* and *P. Cembra*, which inhabit snow-visited regions, with such species as Aleppo pine (*P. Halapensis*), *P. maritima*, *P. insignis*, and *P. Sabiniana*. Judging by the forms of most species of pines it would seem as if this genus is more of a southern origin, than for instance the various genera of firs and spruces, which through their very characteristic

undivided stems and sloping branches indicate their origin in the snowy regions in the north.

C. The globular form. This form is possessed by trees in warm and dry regions or localities. The object of the form is to protect the tree from sun and heat, and to preserve the moisture in the soil around the root. Example: the live-oak, the wild California walnut, the Texas umbrella, and the tropical ceiba, or Bombax tree. The mesquite of the Mojave desert belongs to this form.

D. The umbrella form. This form is principally found in moist tropical climates. The object of the form is to give to the tree as much sun and heat as possible, which can again only be had at a certain altitude above the tops of the dwarfer vegetation. Example: various papilionaceous trees, as well as most varieties of trees in the tropical lowlands of both continents.

In connection with this, I will call attention to the form of the bases of the trunks and of the surface roots in trees growing in moist places, especially in the tropics. The trunks branch out above the soil and form peculiar horizontally compressed roots, sometimes five to six feet high, but only a few inches thick. Such surface roots are found in most tropical trees, as well as in many swamp trees; for instance, the swamp cedar of the Mississippi delta. The object is to steady the tree when floods or excessive rains soften the ground; round roots would then offer much less resistance.

I have here merely tried to outline the principal forms of trees and their trunks and branches, and have endeavored to state the causes which have been at work in moulding them.

There are, however, many other agencies which assist in forming the shape of trees. Such are the elasticity of the wood, which would make the pyramidal shape of the tree less necessary; hairiness of the leaves, which tends to counteract sun and dryness; a tough and thick bark, which would also render sun and heat less injurious—all these must be taken in consideration when we study the forms of trees.

# CATALOGUE OF THE LAND AND FRESH-WATER MOLLUSCA OF LOWER CALIFORNIA.

BY J. G. COOPER.

In an article published in the Proceedings of the California Academy of Sciences, second series, vol. iii, April, 1891, I stated that only three species of land shells had yet been found to inhabit the region on both sides of the boundary-line near lat. 32° 30′, while twenty-one were peculiar to the southern half of the peninsula. I overlooked an incomplete list by Mr. C. R. Orcutt in the "West American Scientist," ii, 61, July, 1886, adding five northern species, which he had traced southward to (or near) lat. 31°. They were identified by Mr. Binney. He and Mr. H. Hemphill, also found three new species on both sides of the line, and added much to the known distribution of others. (See Binney's 3d Supplement to Terr. Mollusks, 1890, pp. 205, 219, 221; also the 4th Suppl., 1892, and the "Nautilus" for 1890–91.)

To furnish a basis for future reference, and to point out some facts needing investigation, I have compiled this catalogue of all the species known from the peninsula and adjacent islands. To simplify the list I omit the sub-generic names, many of which are badly founded, thus using the nomenclature nearly as given by Binney in the "Land and Fresh Water Shells of North America," (Washington, 1869).

That is the latest work giving a full account of the shells of the peninsula, and in the twenty-one years since its issue nineteen land species have been added, eleven or twelve fresh-water, and one marine pulmonate species, doubling the number then known.

Probably no other country has had so many errors made in the localities given for its land-shells, and I therefore give every reference accessible, chiefly from Carpenter's "Mollusca of Western North America," 1856 and 1864, explaining the causes of errors as far as possible.

The geographical range of each species, as far as known, is given in the proper places.

The great variability in external characters observed in all west-coast land and fresh-water mollusca is strongly marked in those of the peninsula, and will doubtless lead to reduction in number of species. I have indicated some of these where most striking, but

at the same time I am in favor of retaining many others as subspecies or varieties. Those who have seen Mr. Hemphill's recent Catalogue of N. Amer. Shells, etc., will understand how the multiplication of names may be carried to excess, and I therefore mention only those that are best defined. Many more local forms must be collected before they can be properly defined.

It will be observed on measuring the peninsula as mapped by the U. S. Coast Survey, that on account of its position, oblique to the meridians, it is much longer than would appear by a calculation from latitudes, the difference being 120 statute miles, and total length 820 miles. The distances apart will thus be greater than the degrees of latitude indicate, by nearly fifteen miles in every hundred, in the long axis of the peninsula.

I refer to this because I have found it necessary to give the latitudes of localities on account of the frequent repetition of names, in places at various distances apart. By referring to Mr. Brandegee's map, we find that towns, old missions, ranches and waterholes (camping places), may each have the same name though far apart, and that bays, points and islands add to the confusion. Thus they can only be distinguished by giving the latitude as near as possible, those on the coast only being exact. Such errors of localities are mentioned as to fourteen out of forty-eight species mentioned in this article.

There are several explanations of the confusion of localities on the peninsula, and most of it comes from the too frequent use of the names of the saints. This would not be so bad, if the surnames distinguishing them had been retained, as first given by missionaries, but being cumbersome they have been gradually dropped in most cases, though retained where very necessary, as with San José del Cabo. In other cases the same names are repeated in the three separate states of the peninsula, as they are in many of the United States, but sometimes three in one state as with the San Juans. Many Indian and other names are also repeated, probably from the ignorance of those naming them. The name of nearly every saint in the calendar is repeated two or three times in those 820 miles.

Carpenter states that Xantus sent shells to Washington from Socorro Island, and other localities, mixed with those of Cape St. Lucas.

On account of the marked differences in the groups of species

inhabiting the mountains, the salt water, and the desert region near the Colorado River, I have divided the list into three parts. The last has not before been included in lists of species belonging to Lower California. Though the desert species do not extend into the peninsula itself below lat. 31° 30′, they have been known for thirty-six years to be found along the Colorado River and its back-water overflow, called "New River," which discharges fifteen miles south of the boundary. Until recently most of them were supposed to be extinct species.

In this catalogue I have used the alphabetical order for convenience of reference, and quoted authorities chronologically in references to localities, etc. Those given in quotation marks have not been confirmed or corrected. Most authors before 1850 confused Upper with Lower California.

Collectors' names are given in italics to indicate that they were at the places mentioned, while those quoting them are usually marked by names in brackets.

The species thus far collected on the peninsula and islands near by have been all of considerable size, and no attempt seems to have been made to find the very small species, except in the part north of lat. 31°, from whence five are known (Nos. 26, 30, 31, 32, 33). Though the more arid regions may not produce them, the moist seashores, damp cañons, and mountain summits, will no doubt still furnish novelties to a careful searcher, many of good size, as shown by Gabb's success in the mountains near the east coast.

## A. Species of the Mountain Regions.

1. BINNEYA NOTABILIS J. G. Cooper, 1863. Santa Barbara Island, Cal., lat. 33° 30′ (types). West coast of Mexico ("*Xanthonyx*" Crosse & Fischer). Guadalupe Island, over 100 miles southwest of San Quintin Bay, near lat. 29°, *Palmer*, *Bryant*, San Quintin, Lower Cal., lat. 30° 24′, *Orcutt*.

2. BULIMULUS ARTEMISIA W. G. Binney, 1861. "Promontory of Cape St. Lucas, lat. 22° 52′, one specimen, *Xantus*.

*B. californicus* Reeve, 1848, is not confirmed as from the peninsula, but is believed by late authors to be from the main land.

3. B. EXCELSUS Gould, 1853. "California," Maj. Rich, La Paz, lat. 24° 10′, later, in Carpenter's work; also found there by *L. Belding*.

4. B. GABBI Crosse & Fischer, 1872. Locality unknown, and only one specimen known, which has characters between those of *B. pallidior* and *B. proteus.* These two allied forms are not reported from any one locality except Cape St. Lucas, therefore a hybrid theory cannot now be proved. It may prove a variety, if *B. vegetus* Gould, which is also intermediate, is not a good species.

5. B. INSCENDENS W. G. B., 1891. "Cape St. Lucas and 450 miles up west coast" (Cedros Is. lat. 28° 02′ not confirmed), Xantus.

Var. BRYANTI J. G. C., 1891. San José del Cabo, lat. 23° 24′, to La Paz, lat. 24° 12′. The east coast form, more developed.

6. B. PALLIDIOR Sowerby, 1833. "Chili," *Cuming* (Pfeiffer). "West coast of peninsula for 350 miles north (to Ballenas Bay, lat. 26° 45′, not confirmed), *Xantus.* La Paz, Maj. Rich. San Juan, east coast, lat. 26° 20′, Lt. Greene, type of *B. vegetus* Gould, 1853. Near San José del Cabo to La Paz, *Bryant.* "San Diego" (Carpenter), not confirmed. Perhaps imported from Chili into gardens with roots, and has since died out northward. No other collectors seem to have found any *Bulimuli* on west coast north of lat. 25°. Mr. Binney mentions several species carried about with roots of banana, etc., from one country to another, and this may account for the introduction of this and *B. proteus* on to the peninsula.

7. B. PILULA W. G. B., 1861. Todos Santos, lat. 23° 25′, to Margarita Island, lat. 24° 20′, *Xantus.* San José del Cabo, *Bryant.*

8. B. PROTEUS Broderip, 1832. "Peru and Chili," *Cuming?*, (Pfeiffer). "Cape St. Lucas," *Xantus.* Northern Peru, *Orton*, (Binney). Perhaps another importation as with *B. pallidior.* The question of their importation as food is yet undecided.

9. B. SPIRIFER Gabb., 1867. Near La Paz, lat. 24° 10′, to San Borgia near lat. 28° 40′, among rocks, in the mountains near east coast, *Gabb.* San Borgia is a little west of the middle line in crossing the peninsula, and thus the most northern and western locality for *Bulimuli* as yet well authenticated. It is about 450 miles from the cape, and may possibly have furnished Xantus with northern specimens, which could be mistaken for *B. pallidior.* With such an extensive range near the east coast it is strange that nobody had found it before. Gabb's figure is more like *B. pallidior* than Binney's.

10. B. SUFFLATUS Gould, 1853. La Paz, lat. 24° 10′, *Maj. Rich*, *Gabb*. San José del Cabo, *Bryant*. The large, east coast form of *B. pilula*.(?) Not found by Xantus, nor on west coast. Bryant also found a few pale brown ones, besides the usual white; both colors in living shells.

11. B. XANTUSI W. G. B., 1861. "Promontory of Cape St. Lucas," four specimens, *Xantus*. The three species reported from the Cape, but not since detected, and two others which Xantus stated to extend so far up the west coast, but not confirmed, were perhaps considered by him as varieties of one or more of the other species. The possibility that he obtained some from Socorro Island, or from the Mexican coast, where he also collected, is to be considered.

12. CYLINDRELLA IRREGULARE Gabb, 1867. Central range of mountains near east coast, around Mulejé, lat. 26° 50′, *Gabb*.

13. C. TAYLORI Pfeiffer, 1861. (*C. newcombiana*) *Gabb*, 1867. Same locality as the last, *Gabb*. Original locality of Pfeiffer's type unknown.

14. HELIX AREOLATA "Sowerby MS." (Pfeiffer, 1845). California *Hinds*, "near Columbia River" (Pfeiffer). This confusion can only be explained by mixing of labels, as Pfeiffer seems to have received these shells from the British Museum for description, with the MS. names. "Margarita Bay, lat. 24° 20′. The only land shell received from the bay," (Pease). Cedros Island, lat. 24° 02′, *Veatch*, a very large form described as *H. veatchii*, Newcomb. These, with *H. levis* and *pandoræ*, form a closely allied group.

In 1867 Mr. W. M. Gabb made a geological exploration of the peninsula for a land company, under J. Ross Browne, traveling the whole length and crossing it ten times. In his report to Mr. Browne, dated San Francisco, 1869 (published in J. R. Browne's Report on Mining Regions), he mentions finding immense numbers of this species, sometimes whitening the ground with bleached shells, and extending from Salada, lat. 24° 15′, to San Tomas, lat. 31° 35′, on west coast. He mentions none of the allied forms, and thus appears to consider them varieties. (See notes on them). Dr. Veatch in same report states that the var. *veatchii* was the only land shell he found on Cedros Island, and on the peninsula east of it.

Unfortunately Gabb nowhere records any notes on other species, except eight, as quoted in this paper.

15. H. DURANTI Newcomb, 1864 (var. *cælata* Mazyck). Santa Barbara Island, J. G. C. (types). Northern race from Healdsburg, 38° 38′, Calif., to Sta. Barbara, *Hemphill*. The var. thence south to San Tomas, lat. 31° 35′, *Yates, Hemphill.*

16. H. KELLETTII, Forbes, 1850. "California," (Santa Barbara),? *Kellett.* "San Juan del Fuaco," (Forbes). This San Juan having been proved to be neither the Straits of De Fuca, nor San Juan Capistrano, southern California, lat. 33° 30′ (northern limit of this shell), is usually considered as the port on the east coast, lat. 26° 20′, visited by Lt. Greene, who did not find this shell there (neither did Gabb). Forbes states that this and *H. pandoræ* were obtained on the *west* coast, probably between "San Diego and Magdalena Bay," lat. 24° 32′. (Carpenter, Rept. on Moll. of West Amer., 1856, p. 239.) Yet it has been generally confounded with the Straits of Juan de Fuca (an explorer, who made no claim to be a saint). Kellett & Wood also surveyed in those straits, and there are both a bay and an island named San Juan there. But none is given on late maps along the west coast of the peninsula, though two "San Juans" are put down as on the gulf shore, one distinguished as a bay, about lat. 26° 20′, the other at a point of land in lat. 28° 25′, and a third one, a camp station, near lat. 28°, twenty miles inland, all visited by W. M. Gabb.

There is also a San Juanico on west coast, lat. 26° 12′, where Gabb collected marine shells (only?) as given in a catalogue printed in the Proc. Cal. Acad, Sci., series i, vol. v, 1875. Even this was confounded by Stearns with San Juan Bay, and it is left uncertain at which place the marine shells were collected, though Gabb in the report before mentioned. states that he collected some at San Juanico, one of the places at which he crossed the peninsula.

The well-known Spanish custom of distinguishing the patron saint of a locality by a surname taken from some local incident, leads to the inference that the one above named was so entitled from either the word fuco (seaweed) or fuego (fire), in either case mis-spelled by Forbes. Then the fact that the two land shells are only known to exist together between lats. 29° 30′ and 30°, the most arid and rocky region on the west coast, suggests that a landing was made

in that region near some ranch which has since been abandoned (like many others), or was never mapped down. The type figured by Forbes was smaller and higher-colored than any variety of the species now known from its more northern range, of which ten or more have been named by Hemphill and others. Its lost station may be one of the small islands. The blunders of authors that were made before 1873 as to this locality are amusing, and it was not until then that explorations had proved that the two species named must have come from the peninsula, together with the two allied forms, while positive locations are only now ascertained. "Central America" given by Reeve is about as bad an error as Straits of Juan *de* Fuca. (N. B.—J. R. Browne states that this is a real family name, but the *San* Juan has it *del* meaning "*of the.*")

17. H. LEVIS Pfeiffer, 1845. "California," *Hinds.* El Rosario, lat. 29° 50′, *Orcutt.* "Columbia River" is another blunder of Pfeiffer's (see *H. areolata*). Varieties indicate that this form may intergrade with that and *H. pandoræ.* It seems limited in range between the two forms named.

18. H. NEWBERRYANA W. G. B., 1858. San Pedro, Cal., lat. 33° 40′, *Yates* (fossil only?). San Diego, *Newberry*, lat. 32° 40′. South to Ensenada, lat. 31° 51′, *Orcutt.*

19. H. PANDORÆ Forbes, 1850. "Santa Barbara as per box label" (Carpenter). "San Juan del Fuaco, Kellett and Wood" (Forbes). "Margarita Island, lat. 24° 20′" (Newcomb, Binney). San Quintin, lat. 30° 24′, *Orcutt*, the only positive location yet obtained, but is reported from further north. Forbes' locality is explained under *H. Kellettii*, but it is not identified for either species lately. The next is probably correct, but conflicts with Pease's statement about *H. areolata.* It seems probable that he, as well as Gabb, considered this form, like the small form of *areolata*, merely one of the varieties of that species. *H. damascenus* Gould, 1856, from "Desert east of California, *Dr. Frick*" (Newcomb), but not confirmed from north of the boundary, was probably from near San Tomas, and is considered a variety of *pandoræ.* As to variations in this group compare the figures already published. W. G. Binney gives copies of the original types in Terr. Moll. of the U. S., vol. iv; in Land and Fresh Water Shells he figures quite different varieties of all these species, and Tryon in the Monograph,

Amer. Jour. of Conchology, vol. ii, gives two others, all these intergrading.

20. H. ROWELLII Newcomb, 1865. "Arizona" *Dr. Frick.* This has lately been confirmed by specimens obtained near Phœnix (Pilsbry). A variety from near Mulejé, lat. 26° 52′, was described as a new species, "*H. lohrii*" Gabb.

An intermediate locality has been recently discovered by Dr. S. Bowers in San Gorgonio Pass, near lat. 33° 40′, at the east base of the San Jacinto Mountains, eight miles south of Indio Station, and about the level of the former lake (or sea), among granitic rocks. There is a limestone bed a little higher up near which they may be found living. Like all found, so far, except Gabb's var. *Lohrii*, they were dead shells, but retained the band, which was faded out in Newcomb's type, as described by him. For this reason, doubtless, their identity was not recognized by Gabb at first, and Dr. Yates also added a synonym or variety in describing Dr. Bowers' shell, as "*H. carpenteri* var. *Indioensis*" in Nautilus, vol. iv, p. 63, 1890. It is also reported with some doubt from "Guadelupe Island, Dr. Palmer" (Binney), who got only young shells, while Bryant found only *H. carpenteri*, but in perfect condition.

21. H. (RUFOCINCTA?) FACTA Newcomb, 1864. Santa Barbara Island, lat. 33° 30′, and San Nicolas Island J. G. C. (types), the large forms from Catalina Island, lat. 33° 20′ "Guadelupe Island, lat. 29°" *Palmer*, *Dunn.* Some of these are subangled and umbilicate. Through *H. gabbi* Newc., and some fossil forms, all are closely connected.

22. H. STEARNSIANA Gabb, 1867. El Rosario, lat. 29° 55′, to San Tomas, lat. 31° 35′, *Gabb*, on west slope only. Coronado Island, lat. 32° 25′, *Hemphill.* Near San Diego, *Orcutt.* A connecting link between the typical *H. kellettii* and those northward, considered varieties of that species. Mr. Gabb's most southern locality seems to fix the southward range definitely.

23. H. TRASKII Newcomb, 1861, and var. CARPENTERI Newc., 1861. Los Angeles, lat. 34°, (type) *Trask*, to Point Conception, lat. 34° 25′, *Yates*, and San Diego, lat. 32° 40′, *J. G. C.* The variety from Tulare Valley, lat. 36°, (type), to Coronados Island, *Dunn*, lat. 32° 25′, and Guadelupe Island, *Bryant*, lat. 29°. The "*H. remondii*" Gabb (not Tryon, 1863), scarcely differs

from *H. carpenteri*, and extends from Trinidad, lat. 28° 45′, on west coast, to Mulejé, lat. 26° 52, on east, also "Guaymas, Sonora, Mex.," Gabb. The Mexican form is, however, different, and is Tryon's type, while the peninsula shells are probably all *carpenteri.*

24. H. TUDICULATA Binney, 1843. Not far south of the boundary line, *Orcutt.* North to lat. 37°, in Sierra Nevada. "Petaluma, California," *Stimpson*, (Gould) is an error in identification.

25. H. (VANCOUVERENSIS Lea, 1839), var. SPORTELLA Gould, 1846. Near the boundary line, *Orcutt.* Those found near San Diego seem to me as near the typical Oregon shell of Lea. *H. vellicata* Forbes "Panama," seems externally very similar, and is united with it by Binney. Not being confirmed from Panama, it forms another proof of the errors in localities due to Kellett and Wood. Mr. Hemphill has lately described the smaller form found south to Ensenada as var. *transfuga.*

26. LIMAX HEMPHILLI W. G. B., 1890. San Diego Mountains to San Tomas, lat. 31° 35′, *Hemphill* (and to lat. 31°? *Orcutt).* This is the species mentioned by me in the Proc. Cal. Acad. Sci., 2d ser., I, p. 13, 1887, at bottom, as perhaps *L. agrestis* Linn. In the "4th Supplement to 5th vol. Terr. Moll.," January, 1892, Mr. Binney now states that this species is found from British Columbia to Lower California, having been confounded, in some cases, with *L. campestris.* An extreme southern form has also been named var. *pictus* by Cockerell. *Anadenus cockerilli* Hemphill, another slug allied to the northern *Ariolimax*, discovered on the San Diego Mountains just north of the boundary, may extend southward.

27. LIMNOPHYSA HUMILIS Say, 1822. Ensenada, lat. 31° 51′, *Orcutt.* Also found in nearly all the United States (and Europe?).

28. PHYSA GABBI Tryon, 1863. Found near middle of west coast of peninsula, *Bryant*, thence north throughout southern half of California. By many called a var. of *P. heterostropha* Say, 1817.

29. P. DIAPHANA Tryon, 1865. In brook at San José del Cabo, *Bryant.* Has same range northward.

*P. elata* Gould, described as from "Lower California, Maj. Rich," was doubtless from Mazatlan only, as given in Carpenter's Catal. The same applies to *P. aurantia* Carpenter.

"*P. heterostropha* Say," 1817, is said by Stearns to be from "Hot Springs, Lower California, *Orcutt.*"

30. PUPA CALAMITOSA Pilsbry, 1889. San Tomas, lat. 31° 35′, *Hemphill.* (To lat. 31°? and San Diego, *Orcutt.* Two species are mentioned by Orcutt without specific names, probably this and *P. hemphilli.*)

31. P. CHORDATA Pfeiffer, 1856. Sinaloa, Mex., near lat. 26°? (type). San Quintin Bay, lat. 30° 24′, "on salt marsh," *Orcutt.* In habits is a link towards *Melampus* and *Pedipes.* From ability to bear salt, it can inhabit the driest zone.

"*P. orcutti* Pilsbry," named by Orcutt, in the West Amer. Scientist, October, 1891. p. 270. is probably a synonym of *P. chordata,* as I find no other notice of such a species.

32. P. HEMPHILLI Sterki, 1890. San Diego to San Tomas, *Hemphill.*

33. P. OVATA Say, 1822. Across the continent in nearly every State. San Diego south to lat. 31°, *Orcutt.*

34. RHODEA CALIFORNICA Pfeiffer, 1846. "Monterey, California," (Pfeiffer), certainly an error. Bogota, New Grenada, *T. Bland.*

Subsp. RAMENTOSA J. G. Cooper, 1891. Mountains north of San José del Cabo, one dead shell in a cave, *Bryant.* It may prove to be now extinct.

35. SUCCINEA OREGONENSIS Lea, 1841. Oregon, (types) and south to lat. 31°, *Orcutt.* Also Vancouver Island, *G. W. Taylor.*

36. VERONICELLA OLIVACEA Stearns, 1871. Nicaragua, west slope, *McNeil* (types). Lower California, *Hemphill.* "Lobitos Creek, California, lat. 36° 52′," *Stearns.* This locality has been recently searched for them in vain by Raymond (1891).

This fresh-water slug leads to the salt-water pulmonate Onchidellas, etc., which I merely catalogue, as nothing new is to be said of them, referring to Binney's work for further information, they being beyond the scope of this article. I add also three non-pulmonates that belong to a genus sometimes inhabiting fresh or brackish water in estuaries.

"*Zonites diegoensis*" Hemphill, 1892, a minute *Helicoid,* from Cuyamaca Mountains, at 4,500 feet altitude, east of San Diego may also be looked for southward.

### B. Marine Species. 1. Pulmonate.

MELAMPUS OLIVACEUS Carpenter, 1857. Mazatlan, Mexico, to Monterey Bay, California, lat. 23° to 36° 30′, salt marshes.

ONCHIDELLA CARPENTERI W. G. B., 1860. Cape St. Lucas, *Xantus*. Doubtfully reported from lat. 48° north.

PEDIPES LIRATUS W. G. B., 1861. Cape St. Lucas, *Xantus*, to San Diego, *J. G. C.*

P. UNISULCATUS J. G. Cooper, 1867. San Pedro, California (types). Head of Gulf of California, *Palmer*.

SIPHONARIA ÆQUILIRATA Carpenter, 1867. Margarita Island, lat. 24° 20′, to South America (Carpenter).

S. LECANIUM Philippi, 1846. Cape St. Lucas to Acapulco, Mexico (Carpenter).

### 2. Estuarine. Non-Pulmonate, operculate.

NERITINA CALIFORNICA Reeve, 1845. Gulf of California.

N. CASSICULUM Sowerby, 1832, is supposed by Carpenter to have been obtained at "San Miguel, lat. 29°, Lower California," by Lieut. Greene, U. S. N., also Mazatlan, Mexico.

37. NERITINA PICTA Sowerby, 1832. Panama, *Cuming*. North to Guaymas, lat. 28°, on gulf coast, and Magdalena Bay, lat. 23° 30′, on west coast of peninsula, in brooks near the sea. This scarcely deserves to rank as a fresh-water shell, as it always occurs near tide-water and must travel through the sea along the coast. The habits of the other two species have not been recorded, but some are known to be entirely marine, others also found in fresh water.

Mr. Binney also includes among "Land and Fresh-water" shells the *Truncatellas*, which are allied to some land genera, but wholly marine, so I omit them here.

### C. Colorado Desert Mollusca.

Very little is known of the Land and Fresh-water species east of the peninsula mountains and north of lat. 31°, but the region is known to share in the arid and barren characters of the desert north of the boundary with scarcely any fresh water, a minimum of rain, and consequently a barren soil. Prof. Blake, Mr. Orcutt and

others have, however, traced the same species so common as fossils in the desert, along New River, and they no doubt exist, sub-fossil if not all living, to the mouth of the Colorado River, or to tide-water, near lat. 32°.

38. AMNICOLA LONGINQUA Gould, 1855. *Living* at Lake Point, Utah, *Hemphill*. *Quaternary*, Nevada to Colorado Desert.

39. ANODONTA (NUTTALIANA) CALIFORNIENSIS Lea, 1852. *Living*, British Columbia to Arizona, Colorado River, *J. L. Leconte*, etc.

40. GNATHODON MENDICUS Gould, 1851. *Living*, Colorado estuary, *Dr. J. L. Leconte*, to Mazatlan, Mexico, in brackish water, *Reigen*.

41. HELISOMA AMMON Gould, 1855. Klamath Lake, Oregon, to Colorado Desert, (and river, *J. G. Cooper*).

42. PHYSA HUMEROSA Gould, 1855. Pyramid Lake, Nevada, to Colorado River, and Texas, *Blake*, *Webb*, etc.

43. PLANORBIS GRACILENTUS Gould, 1855. Colorado Desert, *Dr. T. H. Webb*. *P. leibmanni* Dunker, 1844,? from Vera Cruz, Mexico, is supposed by Binney to be the same species, and identified from Texas also. No confirmation of the desert locality recently.

44. TRYONIA CLATHRATA Stimpson, 1865. Colorado Desert, fossil only? *W. P. Blake*. Lately reported as living in Utah, (Stearns.)

45. T. EXIGUA Conrad, 1855. *Living*, southern Utah (to Dos Palmas Springs, lat. 33° 30′, Colorado Desert, *Orcutt*).

All the above except 40 and 43, are found in vast nnmbers around the shores of the dry lake constituting the desert, as fossils, Quaternary, or later. These are chiefly of more northern species than most of the peninsula shells, Nos. 40? and 43 only, being now limited to the south of the boundary, and are all aquatic. Only 41, 42, 43 are pulmonate, the others being of orders not represented on the peninsula.

The portion of the desert south of the boundary is a triangular tract about 70 miles along the boundary, and 130 along the 115th meridian (which are nearly at right angles), the third side at foot of the mountains being about 150 miles long, and ending near lat. 31°, thus embracing about 4,550 square miles. A large part of this

is a barren saline plain. The mountains west of it are less barren, and must contain some of the species reported from the region westward, near the ocean. No. 20 probably exists there also, as it extends into California, Arizona, and on the peninsula. (See notes on it.)

In reviewing this catalogue we find the terrestrial species to be thirty-two, of which fourteen are found on both sides of the boundary line. The fresh-water species are but eleven (or twelve counting No. 37), and all but this and perhaps 36 cross the boundary. Thus there remain, not found northward, eighteen land species, and one or two fresh-water.

Those also found on the east side of the gulf, or further south, are four or five land and four fresh-water. The total number given, including marine, is fifty-three, of which fourteen are considered peculiar to the peninsula, and two are reported as Chilian also (included in those more southern). Of the peculiar forms eight are Bulimoid, and four Helicoid. The derivation of these, peculiar to the peninsula, will in future be an interesting subject for investigation.

In referring to Lower California as "the Peninsula" it is most correct to include in it only the regions south of the mouth of the Colorado River, about lat. 31° 30′, which excludes the Desert species and also Nos. 15, 18, 24, 25, 26, 27, as their range is now known.

The local distribution of the species depends on latitude, altitude and exposure to the gulf on the east, or the ocean on the west. The gulf having heated water and tropical marine mollusca, besides having its shore protected from the ocean winds by high mountains, shows the greatest number of tropical species on land, the same species sometimes extending four or five degrees of latitude farther north than on the west coast. It is doubtful if any but Helicoid species are found on the west coast north of lat, 25°, while those of the east coast are mostly Bulimoid. Nos. 20 and 23 are the most southern of the former on east side, at lat. 26° 52′, about 280 miles north of Cape St. Lucas. Very much yet remains to be learned regarding distribution of the species.

The most remarkable instance of peculiar distribution is that of the three or four species inhabiting Guadelupe Island, on which we might expect a much larger number to occur, judging from most

other islands, especially those nearér the coast northward, except Cedros Island, which furnishes but one, while Coronados Islands have two, and the Santa Barbara group two to seven each, of which nearly all are absent from the main land. Guadelupe, 100 miles off shore, and volcanic, has been stocked by chance importations from the latter group (No. 21), the peninsula (1, 23, 20?), and the last three are the only species said to be common to the peninsula and the main land of Mexico. The relation of these facts to the distribution of the species, may be perhaps explained by the small shells most easily adhering to birds roosting on the ground.

## MARIPOSA COUNTY AS A BOTANICAL DISTRICT.

## II.

BY J. W. CONGDON.

In mentioning in the former article the shrubs forming the bulk of the chaparral of the wooded foothills, the Christmas Berry (*Heteromeles arbutifolia)* was accidentally omitted. Its abundant and beautiful bunches of red berries are very noticeable, in the winter, on nearly all our hillsides.

In discussing the herbaceous vegetation of this zone, it has seemed to me, that instead of giving a mere enumeration of peculiar or interesting plants, there would be some real scientific value in a somewhat detailed comparison of its flora with the flora of the corresponding portion of the Coast region. I include under the latter designation the territory between the Coast line and the western edge of the San Joaquin plain, with the Bay of Monterey for its southern and Mendocino County for its northern boundary.

Perhaps the most interesting and significant result of such a comparison is the great number of common species found in these tracts separated from each other by the wide expanse of the San Joaquin plain, here of an average width of at least forty-five miles. This intervening plain has a vegetation of its own, consisting of the most common Californian types, mingled with a few peculiar forms limited to that region, and it therefore constitutes with its western boundary of the interior Coast Range a real interruption of the continuous distribution of the great majority of these common species.

In the annexed list of species common to these two districts, introduced plants are indicated by putting the specific name in italics. P, denotes that the plant is also found on the San Joaquin plain; C, denotes that it extends up into the Coniferous zone; and S, that it reaches the Subalpine region.*

Clematis ligusticifolia Nutt. C.
  lasiantha Nutt.
Thalictrum polycarpum Wats. C.
Ranunculus aquatilis L. P.
  Californicus Benth. C.
  hebecarpus H. & A. P.
Aquilegia truncata F. & M. C.
Delphinium hesperium Gray. C.
  variegatum T. & G. P.
Berberis repens Lindl. C.
Platystemon Californicus Benth. P.
Platystigma Californicum Benth. & Hook.
Meconopsis heterophylla Benth. P.
Eschscholtzia Californica Cham. P.
Dendromecon rigidum Benth. C.
Dicentra chrysantha, H. & A.
Cardamine oligosperma Nutt.
Arabis perfoliata Lam.
Erysimum asperum DC. C. S.
Sisymbrium *officinale* Scop. P.
  canescens Nutt. C.
Barbarea vulgaris R. Br. (Clearly native.)
Tropidocarpum gracile Hook. P.
Capsella *Bursa-pastoris* Moench. C. P.
Lepidium nitidum Nutt. C. P.
Thysanocarpus curvipes Hook. P.
  laciniatus Nutt.
  pusillus Hook.
Helianthemum scoparium Nutt. Chemisal.
Silene *Gallica* L. P.

*Nearly all the localities and habitats given in these articles are derived from the personal observations and knowledge of the writer. When the fact is otherwise, the authority relied upon will be given.

Silene Californica Durand. C.
Stellaria *media* L. P. C.
    nitens Nutt. P.
Arenaria Douglasii T. & G.
    Californica Brewer.
Calandrinia Menziesii Hook. P. C.
Claytonia perfoliata Don. P. C.
    exigua T. & G.
Montia fontana L.
Hypericum concinnum Benth. (Abundant with chemisal.)
    anagalloides C. & S. C. S.
Malva *borealis* Wallman. P. C.
Sidalcea malvæflora Gray. C.
    humilis Gray. P.
Geranium Carolinianum L. C.
Erodium *cicutarium* L'Her. P. C.
    *moschatum* L'Her. P.
    *Botrys* Bertolini. (Becoming very abundant.)
Limnanthes alba Hartweg. P.
Oxalis *corniculata* L. P.
Rhamnus crocea Nutt.
    Californica Esch.
        var. tomentella Wats.
Ceanothus sorediatus H. & A. Chemisal.
    divaricatus Nutt. C.
    cuneatus Nutt. C.
Vitis Californica Benth. P.
Æsculus Californica Nutt. C.
Acer macrophyllum Pursh. C.
Rhus diversiloba T. & G. C.
    aromatica Ait.
        var. trilobata Gray.
Lupinus Chamissonis Esch. C.
    rivularis Dougl. C.
    albicaulis Dougl. C. S.
    nanus Dougl. P. C.
    micranthus Dougl. P. C.
        var. bicolor Wats. C.
    leptophyllus Benth.

Lupinus densiflorus Benth. P. C.
Trifolium Macræi H. & A. P.
gracilentum T. & G.
ciliatum Nutt. C.
involucratum, Willd. P. C.
tridentatum Lindl. P. C.
pauciflorum Nutt. C. S.
microcephalum Pursh.
depauperatum Desv.
Melilotus *parviflora* Desf. P.
Medicago *sativa* L. P.
*denticulata* Willd. P. C.
Hosackia gracilis Benth.
strigosa Nutt. P.
parviflora Benth.
Purshiana Benth. P. C.
subpinnata T. & G. P.
brachycarpa Benth. P.
glabra Torr.
Psoralea orbicularis Lindl. C.
macrostachya DC. C.
Vicia Americana Muhl. and vars. C.
Prunus subcordata Benth. C. S.
demissa Walp. C. S.
Nuttallia cerasiformis T. & G.
Rubus ursinus C. & S. C.
Potentilla glandulosa Lindl. C.
Horkelia Californica C. & S.
Adenostoma fasciculatum H. & A.
Alchemilla arvensis Scop. P.
Rosa Californica C. & S. C.
Heteromeles arbutifolia Brewer.
Saxifraga integrifolia Hook. C. S.
Tellima heterophylla H. & A. (Mostly form with entire petals.)
affinis Boland.
Heuchera micrantha Dougl. C.
Ribes Menziesii Pursh. C.
Cotyledon farinosa Benth. & Hook. C.
Lythrum alatum Pursh. var. linearifolium Gray. C.

Zauschneria Californica Presl. C. S.
Epilobiun coloratum Muhl. var. occidentale Wats. C. S.
paniculatum Nutt. C.
Œnothera biennis L. var. grandiflora Lindl.
graciliflora H. & A. P.
dentata Cav. C.
Godetia lepida Lindl. and vars. C. S.
viminea Spach.
Clarkia elegans Dougl.
Boisduvalia densiflora Wats. P. C.
Mentzelia lævicaulis T. & C.
Megarrhiza Californica Torr. P.?
Mollugo verticillata L. P.
Bowlesia lobata Ruiz & Pav.
Eryngium petiolatum Hook. var. armatum Wats.
Sanicula Menziesii H. & A.
bipinnatifida Dougl. P.
Carum Gairdneri Benth. & Hook. C. S.
Œnanthe Californica Wats. C.
Peucedanum utriculatum Nutt. P.
macrocarpum Nutt.
dasycarpum T. & G.
Daucus pusillus Michx. P.
Aralia Californica Wats. C.
Sambucus glauca Nutt. C.
Symphoricarpus racemosus Michx. C.
Lonicera hispidula Dougl.
Cephalanthus occidentalis L. P.
Galium Aparine L.
Valerianella (Plectritis) congesta Lindl. C.
Californica Gray.
Brickellia Californica Gray.
Gutierrezia Euthamiæ T. & G.
Grindelia robusta Nutt. var. rigida Wats. P.
Lessingia Germanorum Cham.
leptoclada Gray. C.
Solidago occidentalis Nutt. P.
Californica Nutt. C.
Aster Chamissonis Gray. C.

Erigeron foliosus Nutt. var. stenophyllus Gray. C.
Philadelphicus L. C. S.
*Canadensis* L. P. C.
Bigelovia arborescens Gray. (Chemisal.)
Micropus Californicus F. & M. P.
Psilocarphus tenellus Nutt. P. C.
Stylocline gnaphalioides Nutt.
Filago Californica Nutt.
Anaphalis margaritacea B. & H.
Gnaphalium decurrens Ives. C.
Sprengelii H. & A.
microcephalum Nutt. C.
palustre Nutt. P. C.
Xanthium *strumarium* L. P.
*spinosum* L. P. C.
Wyethia helenioides Nutt.
Helianthella Californica Gray. C.
Helianthus *annuus* L. P.
*petiolaris* Nutt. P. C.
Californicus DC. C.
Leptosyne Stillmani Gray.
Madia elegans Don. P. C.
sativa Molina var. typica. C.
var. racemosa. C.
var. dissitiflora. C.
filipes Gray. P. C.
Hemizonia Fitchii Gray.
pungens T. & G. (Waif.) P.
multiglandulosa Gray. P. C.
var. villosa. C.
Lagophylla ramosissima Nutt.
Layia gaillardioides H. & A. C.
Achyrachæna mollis Schauer.
Bæria gracilis Gray. P.
uliginosa Gray. P.
Eriophyllum confertiflorum Gray. C.
cæspitosum Dougl. C. S. Alpine.
Rigiopappusleptocladus Gray. P.
Achillea millefolium L. C. S.

Anthemis *Cotula*. C. P.
Matricaria *discoidea* DC. P.
Artemisia Ludoviciana Nutt. C. S.
    dracunculoides Pursh. C.
Senecio *vulgaris* L. P.
    Douglasii DC. P. C.
    aronicoides DC. C. S.
Cnicus Californicus Gray? C. S.
Centaurea *solstitialis* L. P.
    *Melitensis* L. P.
Microseris aphantocarpha Gray. P.
    Bigelovii Gray. P.
    linearifolia Gray. C.
Stephanomeria paniculata Nutt.
Rafinesquia Californica Nutt.
Hypochæris *glabra L.*
Troximon grandiflorum Gray. C.
    heterophyllum Greene. P.
Hieracium albiflorum Hook.
Sonchus asper Vill. P.
Arctostaphylos tomentosa Dougl. C.
    pungens HBK. C. S.
Dodecatheon Meadia L. C. S. Alp.
Fraxinus Oregana Nutt.
    dipetala H. & A.
Apocynum cannabinum L.
Asclepias Mexicana Cav. (fascicularis Decaisn). P. C.
    vestita H. & A. P.
Collomia gracilis Dougl. P. C.
Gilia pusilla Benth. var. Californica Gray. P. C.
    dichotoma Benth.
    micrantha Steud.
    androsacea Steud.
    tenella Benth. P.
    cotulæfolia Steud. C.
    intertexta Steud. C.
    achilleæfolia Benth. P. C.
    tricolor Benth. P.
    inconspicua Dougl. C.

Nemophila aurita Lindl.
maculata Benth. P.
insignis Dougl. P. C.
Menziesii H. & A. P.
parviflora Dougl. P. C. S.
Phacelia circinata Jacq. f. C. S.
tanacetifolia Benth. P.
Emmenanthe penduliflora Benth.
Eriodictyon glutinosum Benth.
Heliotropium Curassavicum L. P.
Amsinckia spectabilis F. & M. P. C. Y.
intermedia F. & M. P.
Krynitzkia Californica Gray. P. C.
oxycarya Gray. P. C.
Plagiobothrys rufescens F. & M. P.
canescens Benth. P. C.
Pectocarya linearis DC. P.
Convolvulus luteolus Gray.
occidentalis Gray.
Cuscuta Californica Choisy. P. C.
subinclusa Dur. & Hilg. C.
Solanum nigrum L. P.
umbelliferum Esch.
Nicotiana Bigelovii Wats. P.
*glauca* Graham.
Scrophularia Californica Cham. C.
Collinsia bicolor Benth.
parviflora Dougl. P. C.
Penstemon breviflorus Lindl.
Mimulus Douglasii Gray. P.
glutinosus Wendl.
cardinalis Dougl. C.
luteus L. P. C.
pilosus Watson. C. P.
Veronica peregrina L. P.
Castilleia foliolosa H. & A. (Chemisal.)
parviflora Bong. C.
Orthocarpus attenuatus Gray. P.
purpurascens Benth. P.

Orthocarpus erianthus Benth. P.
Cordylanthus filifolius Nutt. C.
pilosus Gray. C.
Pedicularis densiflora Benth.
Aphyllon fasciculatum Gray. C.
Californicum Gray.
Monardella villosa Benth.
Pogogyne Douglasii Benth. P. C.
serpylloides Gray. P.
Sphacele calycina Benth.
Salvia Columbariæ Benth.
Scutellaria angustifolia Benth.
tuberosa Benth.
Marrubium *vulgare* L. P. C.
Stachys albens Gray. C.
Trichostema lanceolatum Benth. P.
Plantago *major* L. P. C.
*lanceolata* L. C.
Patagonica Jacq. P. C.
Rumex salicifolius Weinm P.
*crispus* L. P. C.
*conglomeratus* Murr. C.
*Acetosella* L. P. C.
Polygonum *erectum* L. P. C.
*aviculare* L. P. C.
nodosum Pers.
*Persicaria* L. P. C.
*Convolvulus* L. C.
Eriogonum nudum Dougl. C. S.
virgatum Benth. P. C.
vimineum Dougl. P. C. S.
Lastarriæa *Chilensis* Remy. P.
Pterostegia drymarioides F. & M. P. C.
Amarantus *retroflexus* L. P. C.
*paniculatus* L. C.
*albus* L. P. C.
*blitoides* Wats.
Chenopodium *album* L. P. C.
*murale* L. P. C.

Chenopodium leptophyllum Nutt. P.
*Botrys* L. P. C.
*ambrosioides* L. P. C.
Umbellularia Californica Nutt. C.
Urtica holosericea Nutt. P. C.
*urens* L. P.
Eremocarpus setigerus Benth. P. C.
Euphorbia serpyllifolia Pers. P.
leptocera Engelm. C.
Callitriche verna L. P. C.
Alnus rhombifolia Nutt. C.
Salix nigra Marsh. P. C.
longifolia Muhl. P. C.
lævigata Bebb. P.
lasiolepis Benth. P. C.
Populus Fremontii Wats. P.
Quercus lobata Née. C.
Douglasii H. & A.
chrysolepis L. C.
Kelloggii Newberry. C.
Phoradendron flavescens Nutt.
Juniperus Californica Carr.
Pinus Sabiniana Dougl.
Sisyrinchium bellum Wats.
Allium attenuifolium Kell.
Brodiæa capitata Benth. P. C. S.
laxa Wats. C.
ixioides Wats. C.
lactea Wats.
Chlorogalum pomeridianum Kunth. C.
Fritillaria biflora Lindl.
lanceolata Pursh, *var.* floribunda Benth.
atropurpurea Nutt. C.
Calochortus albus Dougl.
luteus Dougl.
venustus Benth. C. S.
Lemna minor.
Zannichellia palustris L.
Potamogeton pauciflorus Pursh.

Luzula comosa Meyer. C. S.
Juncus Leseurii Boland. P.
effusus L. C.
*bufonius* L. P. C.
tenuis Willd.
Carex marcida Boott. C. S.
glomerata Thunb.
angustata Boott. C.
Panicum *sanguinale* L. P. C.
dichotomum L. C.
crus-galli L. P.
Phleum *pratense* L. P.
Polypogon *Monspeliensis* Desf. P. C.
*littoralis* Smith. P. C.
Agrostis *alba* L. P. C. S. Native. S.
scabra Willd. C. S.
Gastridium australe Beauv. P. C.
Stipa setigera Presl. C.
eminens Cav.
viridula Trin. C.
Avena *fatua* L. P. C.
Aira danthonoides Trin. C. S.
Holcus *lanatus* L. P. C.
Melica imperfecta Trin. C.
*var.* refracta Thurb.
bulbosa Geyer. C.
Atropis tenuifolia Wats. C.
Poa annua L. P. C.
Poa pratensis L. P. Native. C. & S.
trivialis L. C. Apparently native.
Festuca *Myurus* L. P. C.
microstachys Nutt. P. C.
Bromus *maximus* Desf. P. C.
*rubens* L. P. C.
*secalinus* L. P. C.
*racemosus* L. P. C.
Ceratochloa *unioloides* Beauv. P.
Lepturus Bolanderi Thurb.
Hordeum *nodosum* L. C.

Hordeum *murinum* L. P. C.
Elymus condensatus Presl. C.
  Sibiricus L. C. S.
  Sitanion Schult. P. C.
Polypodium vulgare L. C. S.
Gymnogramme triangularis Kaulf. C. S.
Pellæa andromedæfolia Fee. C.
  Ornithopus Hook. C.
Pteris aquilina L. C.
Woodwardia radicans Sm. C.
Aspidium rigidum Sm. C. S.
  munitum Kaulf. C.
Cystopteris fragilis Bernhardi. C. S.
Selaginella rupestris Spreng. C. S.
Azolla Caroliniana Willd. P.

This list shows that out of 318 native species common to this district and the coast, as above defined, only 105, or about one-third, are found in the intervening plain. It is possible, but not probable, that a more thorough exploration of the plains would add something to the number of the species found there, but could hardly produce any serious change in the ratio. On the other hand, out of the 66 naturalized plants enumerated, 59 are pretty certainly found on the plains, showing that they have accompanied the successive waves of immigration which first swept over the foothills in the search for gold, but have now largely flowed back upon the plains, seeking the agricultural treasures of the soil.

A further examination of the same list shows how rapidly the plants of the plains and lower foothills disappear as we ascend into mountains. Of the 105 plants of the plains found in this zone, only 37 reach the coniferous belt and only three the subalpine district. Probably there are really only two of these, as *Achillea millefolium* is pretty certainly naturalized on the plains, having been introduced with grass seed. Out of the 213 remaining species 115 extend into the coniferous belt, of which 27 reach the subalpine region. Two of these, *Dodecatheon Meadia* and *Eriophyllum cæspitosum*, attain the alpine summits in some of their varieties which, however, may yet be specifically distinguished from the lower forms.

Coming now to the species really characteristic of or limited to

the foothills, which are found in this zone, so far as they are known to me, they will be found in the next list, which follows the same rule as the former one, except that items of supposed interest in regard to rare or new species are more freely introduced.

Isopyrum occidentale H. & A. Shaded hillsides. Mariposa.
Delphinium decorum F. & M., var. patens Gray. Same localities. C.
Arabis arcuata Gray. Face of cliffs. Mariposa. Hite's Cove. C.
Streptanthus barbatus Wats.? Sepals not bearded. Rocky places. Mariposa. Agua Fria.
    polygaloides Gray. Rocky sidehills. Mariposa.
Nasturtium palustre DC. Banks Lower Merced.
Lepidium Menziesii DC. The common species here.
Thysanocarpus radians Benth. Hornitos.
Viola aurea Kell. The only yellow violet proper here. C. S.
    chrysantha Hook. This beautiful representative of the *tricolor* type is not rare in open grassy places in March.
Polygala Californica Nutt. Rocky cliffs. Merced River.
Hypericum Scouleri Hook. Stream banks. C.
Sidalcea Hartwegi Gray. Thickets and open grounds.
Fremontia Californica Torr. Chaparral-covered hillsides. May. C.
Linum micranthum Gray. Rocky places.
Trifolium bifidum Gray. Differs from *T. gracilentum* in its strictly upright growth. Open woods.
Hosackia stipularis Benth. Chemisal. Agua Fria.
    grandiflora Benth. Shaded spots. Mariposa. April and May.
Hosackia argophylla Gray. Cliffs. Hite's Cove.
Astragalus Congdoni Wats. Chemisal. Hite's Cove.
Lathyrus sulphureus Wats. Thickets and stream banks. Common. C.
Cercis occidentalis Torr. Rocky places. A white variety occurs. March and April.
Cercocarpus parviflorus Nutt. Frequent. March.
Calycanthus occidentalis W. & A. Rocky beds of streams. Hite's Cove, etc. C.

Saxifraga Parryi Gray. Rocky banks of Merced River and vicinity of Benton Mills. This is an interesting link between our flora and that of the extreme southwestern coast of the State.

Philadelphus Lewisii Pursh. Rocky banks of streams. Frequent.

Ribes leptanthum Gray. Rocky places, descending almost to the plains. December to March.

Sedum obtusatum Gray. Rocks. Not rare. C.

pumilum Benth. Rocks near Hornitos and Mormon Bar. March and April.

Epilobium minutum Lindl. Wooded places. Common.

Godetia. A form classed by Watson as a var. of *epilobioides*, but clearly different. Thickets. Common. C.

epilobioides Wats. Rocky places. Not rare.

biloba Wats. North hillsides. Mariposa.

Boisduvalia Torreyi Wats. Stream beds. Mariposa. Frequent.

Heterogaura Californica Rothr. Shady rocky places. Frequent. C.

Datisca glomerata B. & H. Banks of streams. Frequent.

Mentzelia dispersa Wats. Shady hillsides. Mariposa. Occasional.

Lindleyi T. & G. Cliffs. Hite's Cove. March.

Cucurbita perennis Gray. Occasional. Perhaps introduced near the plains.

Sanicula bipinnata H. & A. Rocky places. Common.

tuberosa Torr. Shady hillsides. March and April.

Deweya Hartwegi Gray. Cliffs. Hite's Cove, Benton Mills, etc. April.

Osmorrhiza brachypoda Torr. Woods. Common. C.

Podosciadium Californicum Gray. Rocky beds of streams. White's Gulch. May.

Peucedanum caruifolium T. & G. Rocky places. Common.

Ferula dissoluta Wats. Rocky places. Mariposa, Agua Fria, etc. April.

Caucalis microcarpa H. & A. Dry rocky places. Common.

Cornus glabrata Torr. Banks of streams. Scarce.

Galium Bolanderi Gray. Thickets. Everywhere. C.

Pentachæta exilis Gray, *var.* discoidea Gray. Open grassy places. March and April.

Lessingia nana Gray. Open grassy ground. Mariposa. August and September.

Corethrogyne filaginifolia Nutt, *var.* tomentella Gray. Hite's Cove. October and later.

Stylocline filaginea Gray. Benton Mills. April.

Evax caulescens Gray. Clayey ground. Common.

Balsamorrhiza Bolanderi Gray. Dry summits of chaparral-covered hills. Bear Valley Mt., etc. April.

Wyethia, related to *W. angustifolia*, and referred to under that species in Bot. Cal. Dry woods. C.

Hemizonella Durandi Gray. Dry ground. Benton Mills, etc. C.

Hemizonia virgata Gray. Is *the* tar weed, here, covering all the open grounds in August and September.

Wrightii Gray. Adventive from below, especially near the plains.

mollis Gray. Open grounds. Most common near and in the coniferous belt. C.

truncata Gray. Rocky sidehills. Mariposa.

Lagophylla glandulosa Gray. Open clayey grounds and roadsides. Mariposa and vicinity. May to December.

filipes Gray. Rocky beds of streams. Gaudalupe mountain, etc. May—July.

Layia Fremontii Gray. Open grassy places towards the plains. March.

Bæria debilis Greene. Shade of chaparral bushes. Lewis'. April.

Chænactis glabriuscula DC. Clayey soils. Frequent.

Helenium Bigelovii Gray. Rocky beds of rivers. Benton Mills and above. C. S.

Troximon retrorsum Gray. Shaded hillsides. Mariposa, and more common in the zone above. C. S.

Nemacladus ramosissimus Nutt. Rocky soils, nearly the same range as the last. C.

Githopsis specularioides Nutt. Wooded hillsides. Common.

Heterocodon rariflorum Nutt. Rocky and wet places. Not rare.

Arctostaphylos glauca Lindl. Mariposa. More common here than *A. pungens*, which grows principally higher up.

Gomphocarpus tomentosus Gray. Rocky hillsides. Benton Mills, etc.

cordifolius Benth. Open thickets. Common.

Asclepias speciosa Torr. Open grounds. A rather showy species. More common in the next zone. Stockton, etc. C.

Erythræa venusta Gray. Water courses. Frequent. More abundant in the zone above. C.

Gilia Bolanderi Gray. Open clayey grounds. Mariposa, etc. Scarce.

filicaulis Torr. Dry hillsides. Mt. Bullion, etc. Not common.

Ellisia membranacea Benth. Open rocky places near the plains.

Phacelia humilis T. & G. Rocky shaded places. Mariposa and above. C. S.

hispida Gray. Rocks. Agua Fria, etc. March.

phyllomanica Gray (or bipinnatifida). Shaded rocks. Mariposa, etc.

Plagiobothrys tenellus Gray. Moist grounds. Frequent. C.

Torreyanus Gray. Same localities. C.

muriculatus. Wooded hillsides. C.

barbigerus Gray. Open shady places. Darrah Road, etc. C.

sparsiflorus Greene. Rocky banks of streams. Mormon Bar.

Echinospermum Greenei Gray. Open grassy places. Mariposa.

Cynoglossum læve Gray. Moist hillsides. April.

Pectocarya pusilla Gray. Clayey soils near Mariposa. April.

Datura meteloides DC. Stream beds. Probably introduced from below.

Verbascum *Thapsus* L. This common eastern weed is fast becoming too frequent in Mariposa county. C.

Antirrhinum leptaleum Gray. Open and especially cultivated grounds. Mariposa and above. C.

Breweri Gray. Occasional on hillsides, near Mariposa.

Collinsia tinctoria Hartg. Wooded hillsides and stream banks. Mariposa and above. C.

Penstemon heterophyllus Lindl. Open grounds, Mariposa, etc.

azureus Benth. Higher up. Probably a form of the last. C.

Mimulus nanus Hook. & Arn. Wooded hillsides. Mariposa and above. C.

Mimulus Congdoni Robinson. Shade of buckthorn clumps. Mariposa and vicinity. March.

Torreyi Gray. Wooded hillsides and wet grounds. Mariposa and above. C. S.

Bolanderi Gray. Open clayey soils. Hite's Cove. Mariposa and above. C.

gracilipes Robinson. Rich rocky soils. Mormon Bar and above. April.

Pulsiferæ Gray. Moist grounds. Bootjack Ranch. More common above. C. S.

inconspicuus Gray. Wooded hillsides. Mariposa and above. C.

Palmeri Gray. Banks of streams. Rare near Mariposa. Occasional above. C.

floribundus Dougl. Rocky beds of streams, etc. Very frequent. C. S.

Orthocarpus Bidwelliæ Gray. Open spots in chaparral. Darrah Road.

*spec. undescribed.* Mariposa and above. Rocky hillsides. March.

Cordylanthus tenuis Gray. Clayey soils. Darrah Road.

Pycnanthemum Californicum Torr. Banks of streams. Mariposa and above. C.

Monardella lanceolata Gray. Open uncultivated grounds. Mariposa and above. C.

candicans Benth. Occasional in open spaces in the chaparral. Mariposa, etc.

Scutellaria Bolanderi Gray. Banks of streams. Mariposa, and more common above. C.

Trichostema oblongum Benth. Beds of streams. Mariposa Creek, etc.

Eriogonum stellatum Benth. Rocky places. Josephine Mine. More common above. C. & S.

hirtiflorum Gray. Open clayey soils. Hite's Cove. Mariposa, etc.

Chorizanthe membranacea Benth. Rocky places. Hite's Cove. Agua Fria, etc.

Hesperocnide tenella Torr. Shaded rocks. Mormon Bar, etc. April.

Euphorbia ocellata D. & H. Open clayey soils. Mariposa and below.

dictyosperma P. & M. Open hillsides. Mariposa, etc.

Quercus Wislizeni ADC. Dry wooded hillsides, almost everywhere below the evergreen belt.

Asarum Hartwegi Wats. Rocky places. Mariposa, etc. April.

Arceuthobium occidentale Engelm.? Everywhere on *Pinus Sabiniana*. C.

Pinus ponderosa Dougl. Begins here but reaches its grandest development in the zone above. C. S.

Allium hyalinum Curran. Rocky places. Mariposa, etc. April. Two weeks earlier than the associated *A. attenuifolium* Kell.

Brodiæa grandiflora Sm. Open grounds. Mariposa, etc. Frequent. May to June.

Stropholiron Californicum Torr. Climbing over the bushes everywhere from Mariposa, etc., above. The leaves die early. C.

Fritillaria atropurpurea Nutt. Shaded hillsides and deep woods. Mariposa and above. C.

Erythronium Hartwegi Wats. Shaded hillsides, principally near Mariposa. April. This is the most appropriate "Mariposa Lily."

Odontostomum Hartwegi Torr. Rocky beds of streams. Agua Fria. April and May.

Juncus Congdoni Wats. Bed of the Chowchilla, etc. April and May.

Cyperus aristulatus Roth. Beds of streams. Chowchilla and above. C.

Agrostis virescens HBK. Rocky banks of streams. Mariposa and above. C.

Cinna macroura Kunth. Rocky banks of streams. Mariposa and vicinity.

Triticum caninum L. Rocky banks of streams. Mariposa and above. C.

The 124 species above named illustrate the same fact as the former list, that the species change rapidly as we approach the mountains. Out of the whole number only 44 enter the coniferous belt, and of these only nine reach the subalpine region. Out of the 508

species enumerated in these two lists as constituting the flora of the wooded foothills, 440, or 87 per cent. nearly, are plants apparently native in the district, and about 13 per cent. are pretty certainly introduced, though some of these are native further south. Of the 440 native species 318, or a little over 72 per cent., belong also to the coast region, though only 105, or 24 per cent., occur in the intervening San Joaquin plain; while of the 122 native plants which begin to grow here, 78, or nearly 18 per cent., of the whole number are, in this county at least, limited to this zone.

## NOTES ON LILIACEÆ. II.

BY CARL PURDY.

Every observing botanist recognizes the extent to which plants are influenced by surroundings. Climate, soil, exposures and moisture are factors which greatly effect the appearance of a plant, not only in a general way but also sometimes structurally.

In no country are there greater variations in natural surroundings than in California, and our flowers reflect their surroundings. It is indeed wonderful how different a species, which can be proved to be the same, will appear in different places. So different indeed that such forms are frequently given different botanical names and treated as distinct species. On the other hand it is not infrequent that careful botanists attribute to accidental circumstances a difference which really marks a variety or species. Between the extreme of considering each accidental variation a variety or species, and the other extreme of merging two distinct species under the idea that the variation is inconstant and accidental, lies a mean very difficult to obtain, and it is not surprising that so many errors have been made and obtained a stronghold in botanical works.

I suppose that no class of plants are more susceptible to the influence of surroundings than the Liliaceæ. I tried for years to satisfy myself as to whether species were distinct or not, by comparison of specimens and observations of the plants in their native homes, but I was forced to the conclusion that the only way to settle the matter was by cultivating them side by side, thus eliminating all variations due to soil and climate. This, rather than field work, is my present line of study, and carefully followed out will be, I feel sure, productive of valuable scientific results.

In this work I find two obstacles. The first is the difficulty of securing the bulbs. Of course the larger number can be obtained, but many species are only to be had by journeys to out of the way localities. It may be years before some can be secured. The cultivation of these bulbs is by no means a simple matter. It requires care and close study of conditions. I am pleased to say that I am now able to grow most species quite satisfactorily.

The problems to be solved are many. In Lilium, twelve or more species have been described from this coast. It is likely that cultivation will show the number of varieties to be much greater. In Calochortus, the field of work is large. There is much confusion here. I have no doubt but that several species will, in cultivation, prove to be identical. Here, as often elsewhere, the question arises as to what degree of variation justifies the formation of a species or variety, and how much greater the variation should be for one than the other. I should like to see this question discussed.

In the genus Calochortus it is peculiarly pertinent; since several so called varieties are as well defined as others called species, for instance, *Calochortus venustus*, *C. luteus*, and *C. luteus* var. *oculatus* and var. *citrinus*, following Botany of California, as to names. *C. luteus*, however, is a clearly defined species as to habit, gland, etc., and so is *C. venustus*, the latter much finer and larger in flower, more varied in markings and color. No one having seen either *C. luteus*, with its small flower, single color and peculiar gland, or *C. venustus*, with its markings and brilliancy, would hesitate to identify either anywhere.

Now, *C. luteus* var. *oculatus* and var. *citrinus* have the gland of *C. luteus* and that is all. In all other details their habit is that of *C. venustus*. While *C. luteus* var. *oculatus* and var. *citrinus* meet each other and cross in an interminable number of forms, I have never seen any tendency to cross with *C. luteus*. In fact, I have found the latter the least variable of species. In a field the flowers are alike, and those from far distant localities are identical. Is it not straining a point to refer two very distinct forms to a species that is invariable? To suppose them to have varied from *C. venustus* is still more of an improbability, since there are structural differences. I think they form a distinct species instead of varieties, and possibly two species.

In the genus Erythronium, botanists are still at sea, and all along the line of Liliaceæ there are interesting points to be solved.

# NOTE ON HELIX YATESII Cooper.

BY HENRY HEMPHILL.

There seems to be an erroneous impression prevailing among our conchologists in regard to the habits of this interesting little mollusk that needs to be corrected. The fact that the five dead specimens—two perfect and three imperfect ones—from which Dr. Cooper drew his descriptions of the shell and his genus Ammonitella, were found in the cave at Cave City, Calaveras County, California, has led some of the writers on our West Coast shells to regard this mollusk as a rare, isolated cave dweller, that prefers the shadow and gloom of caverns in which to pass its existence, rather than the light of the outside world. This, however, is a mistake which any intelligent or close observing collector can easily determine by a visit to the cave, and a short ramble over the hills in its vicinity.

Several years ago I visited Calaveras County for the purpose of collecting this and the other shells of that region, and to my surprise I found this little mollusk near Murphy's, seven miles away from the cave, æstivating under stones on north hillsides, while numbers of dead shells lay bleaching in the sunshine, where they had fallen in the struggle for life.

Around the entrance and on the slopes of the hill in which the cave is situated, and also on the adjacent hills, it occurred plentifully, and it is not a rare shell in these localities.

On entering the cave I found but few specimens inside. Most of these I took from the crevices in the rocks on each side of the entrance within the cave, a few only being found on the floor, and none beyond a distance of fifty feet from the entrance, although I searched closely for this and other species with the aid of a good light.

When fairly within the cave, and looking towards the entrance, I could see the daylight through the crevices between the rocks on each side of the opening through which we entered, which at once revealed to me the mystery of the presence of this mollusk within this cool and shady retreat.

To those acquainted with the habits of land snails it will be readily seen how these creatures, in seeking safe and convenient places in which to hibernate and pass the long, dry and hot summer season and cold winter months, would naturally crawl into

these crevices between the shelving ledges, and finding them moist and cool, would continue their explorations until they entered the chambers of the cave; and thus having easy ingress and egress, they have no doubt continued their visits for many years, on the approach of the dry season, while some, perhaps, never leave the cave.

The fact that there are so few specimens found within the cave, and so many outside and miles away, æstivating under stones, is sufficient evidence that the presence of this mollusk within the cave is simply accidental, and that it is not its natural habitat.

In his remarks upon this shell, Dr. Cooper calls attention to its resemblance to Planorbis and Ammonite, its relations to *H.? polygyrella* and Gastrodonta, and its affinity to Macrocyclis, with all of which I agree, and which goes to show very plainly, I think, that nature does not represent any particular genus by the shell. If she indulges in such freaks as genera at all, she determines that matter by modifications of the structure of the animal, and not by the object formed or moulded by the animal itself; and this little shell, compounded of several so-called genera as it seems to be, is a good illustration of this fact.

In support of this I can do no better than repeat Dr. Cooper's own words: "It would have been supposed to be a Planorbis if found near water and if the streams in that country had not been thoroughly searched by many collectors. It resembles Planorbis in the inverted spire and in the partial enclosure of each whorl in the next larger, so that the spire shows only a small portion of the whole shell.

"The consequent vertical narrowing of the aperture, and, indeed, of the whole interior, is also found in some species of Planorbis, but not in any American Helicoid. Indeed, it is inconsistent with the character of 'Helix,' as defined by Lamarck, and this shell could not, therefore, be embraced in that most comprehensive genus. The resemblance to an Ammonite is conspicuous in a lateral view. It probably belongs to Helicellidæ, notwithstanding its thickened labrum, which we find also in *H. ? polygyrella* and *G. interna*, and some other species. Though toothless, it is apparently nearly allied to the former, in which the spire is flat and of 7 to 8 whorls. It also shows affinity to Macrocyclis in the oblique flattening of the outer whorls and its strong deflection near the mouth."

No stronger argument could be advanced to show how utterly valueless the shell is for the purpose of determining genera. Had this shell been accidentally washed into the creek below and found dead in the water as it was found in the cave, neither Dr. Cooper nor any other naturalist would have hesitated a moment to have described it as a Planorbis, which it closely resembles.

Even with the animal known, the authorities do not agree on its genera, or its position in our system of classification.

Mr. Tryon recognized Dr. Cooper's genus Ammonitella, but Mr. Binney, Mr. R. E. C. Stearns and Mr. Pilsbry, equally as good authority, refer the shell to Gonostoma.

Mr. Binney, than whom there is no better authority on these animals, says of Gonostoma: "Animal, as in Patula."

Now, if the animal is a Patula, should we not place this shell with or near the genus Patula, instead of separating it as we do now?

I do not write this in a spirit of criticism, but to draw attention to what I believe to be an error in our system of classification of these creatures, and which seems to me to be inconsistent with nature and the philosophy she teaches.

## NOTES ON THE CICINDELIDÆ OBSERVED IN SAN DIEGO COUNTY, CAL.

BY F. E. BLAISDELL.

*Omus.* It is doubtful if any species of *Omus* occurs south of the 35th parallel. At Port Harford, San Luis Obispo County, I have taken what is probably *O. lecontei*, and I consider that locality the southern limit of distribution of the genus.

*Cicindela latisignata* Lec. Plentiful from May to October, on the ocean beach and alkaline flats; not found about inland streams and ponds.

*Cicindela tenuicincta* Schaupp. In company with the preceding form, with which it is identical. The creation of the present subspecies is ostensibly based upon the elytral markings. In *latisignata* there is an excessive increase in the white; while in *tenuicincta* there there is a close approach to the typical pattern as exhibited by *vulgaris* "the central pattern from which all forms observed in our Cicindelæ have been derived, either by a progressive spreading of the white, or its gradual absorption and fragmentation."—Horn.

From the above propositions, it is to be argued that *latisignata* has been evolved from *tenuicincta*, the latter being naturally and logically the fundamental species, the former only so by the arbitrary laws governing the priority of nomenclature.

*Latisignata* may be regarded as an incipient species in progress of divergence from a more normal type, and will in all probability in the course of time become isolated and perpetuated.

At the present time the two forms are to be considered as identical.

Any collector of these insects cannot fail to note the following facts while in the field:

1. That the two forms under consideration form the extremes of a series, in which the intermediate types of elytral variation are exceedingly abundant and exhaustive.

2. That the normal *tenuicincta* in numbers considerably exceed the broad-banded form, the latter being comparatively scarce.

3. That all of these forms are intimately associated.

4. That eight-tenths of the couples taken *in coitu* will represent a ♂ or ♁ of one of the extremes, with the opposite sex an intermediate.

From the above can be seen that they interbreed entensively, inhabit the same geographical region, and exist under the same environment and climatic conditions.

If any one of the forms inhabited a more or less distinct geographical district, so that it would be possible to admit of different climatic influences and environment, without constant interbreeding, the idea of races could be sustained.

Correctly and philosophically speaking, *Cicindela tenuicincta* is a fundamental species, with a strong tendency towards variation.

*Cicindela obliquata* Kirby. Occurs upon the borders of the Big Laguna, in Temecula Valley.

*Cicindela vibex* Horn. Ocean beach, near Oceanside.

*Cicindela guttifera* Lec. According to Schaupp's "Synopsis of the Cicindelidæ," this is the form that occurs throughout the county, about all the inland streams and ponds, as well as upon the ocean beach. In *12-guttata* the elytral markings are broken into spots. Specimens of *guttifera* taken in Arizona are quite green. This color begins to be perceptible in the specimens collected in the central portion of the county, becoming deeper as we approach the desert region and Colorado valley.

*Cicindela hirticollis* Say. Very abundant from June to October; varies in size without perceptible variation in elytral markings; occurs on ocean beach and alkaline flats; not inclined to inhabit the borders of inland fresh-water pools.

*Cicindela sigmoidea* Lec. A very abundant species, actually swarming on the bay beach during June and July. Attracted in considerable numbers by the electric light.

*Cicindela gabbii* Horn. Occurs in August on alkaline flats. Very desirable and not abundant.

*Cicindela hæmorrhagica* Lec. Occurs throughout the county. Formerly abundant about San Diego Bay, but has retreated before the advance of civilization, and at the present time is exceedingly rare.

*Cicindela pacifica* Schaupp. Occurs at Del Mar in August and September. From the sea-shore it extends up Peñasquitos Creek for the distance of fourteen miles to Poway (elevation 700 feet). Have not observed it at other inland points.

## ADDITIONS TO THE CATALOGUE OF SAN FRANCISCO PLANTS.

BY KATHARINE BRANDEGEE.

6*a*. RANUNCULUS BLOOMERI Gray. Bot. Cal. ii, 426. In wet adobe soil on the northern slopes and near the base of a high hill in South San Francisco. April—May.

31*a*. *Lepidium bipinnatifidum* Desv. Jour. Bot. iii, 165. Common about roadsides and paths, South San Francisco. April—July.

47*a*. STELLARIA LITTORALIS Torr. Pac. R. Rep. iv, 69. Bluffs above the sea at Land's End Station near Point Lobos. April—May. "Shore-Chickweed."

62*a*. HYPERICUM SCOULERI Hook. Fl. Bor.-Am. i, 111. Lake View. April—July.

*Ulex Europæus* L.—"Gorse," "Furze," "Whin." This plant, native of Europe, has escaped and covers many acres near the county line, between Visitacion Valley and Ocean View. On the

bare stony hills it is low and decumbent, but in the ravines and sheltered spots it reaches 6–8 feet.

114*a*. HOSACKIA STRIGOSA Nutt. T. & G. Fl. i, 326. Along the railway, Point Lobos. April—May.

142*a*. TELLIMA AFFINIS (Gray. Proc. Am. Acad. vi, 534). The most common species in our limits. March—May.

153*a*. CALLITRICHE SEPULTA Wats. Proc. Am. Acad. xiv, 298. Surface of mud about pools, Presidio. April—May.

ECHINOCYSTIS MARAH Wats. This species was supposed to be extinct within our limits, but it still persists in the gorse thickets near Visitacion Valley.

APIASTRUM ANGUSTIFOLIUM Nutt. T. & G. Fl. i, 644. Point Lobos, South San Francisco, Visitacion Valley. April—May.

204*a*. GALIUM CALIFORNICUM H. & A. Bot. Beech. 349. South San Francisco, Visitacion Valley. April—June.

255*a*. LAYIA CALLIGLOSSA var. OLIGOCHÆTA Gray. Fields at the upper end of Visitacion Valley. April.

285*a*. *Cnicus arvensis* (L. spec. 1149.) About the base of Telegraph Hill. May—October. "Canada Thistle."

The spread of this plant is to be dreaded; though apt to be less troublesome in our dry climate than in the eastern states, it will be difficult to eradicate from irrigated fields and borders of ditches.

*Centunculus minimus* L. spec. 169. Cliffs between Lobos Creek and Fort Point, and very abundant about the Presidio in company with *Microcala quadrangularis*. April.

328*a*. NEMOPHILA PARVIFLORA Benth. Trans. Linn. Soc. xvii, 275. Common in rocky bushy places. March—May.

329*a*. NEMOPHILA AURITA Lindl. Bot. Reg. t. 1601. Near the northern base of a high hill in South San Francisco. April—May.

334*a*. PHACELIA DOUGLASII (Benth. Trans. Linn. Soc. xvii, 276). Near Lake Merced. April—May.

370*a*. ORTHOCARPUS ATTENUATUS Gray. Pac. R. Rep. iv, 121. Potrero. April.

372*a*. ORTHOCARPUS FAUCIBARBATUS Gray. Pac. R. Rep. iv, 121. Presidio, Potrero, Visitacion Valley. April.

? EQUISETUM ARVENSE L. Marshy banks and ditch sides. Visitacion Valley.

# NOTE ON A CALIFORNIAN LOLIGO.

BY HENRY HEMPHILL.

In the July (1891) number of the Nautilus, in an article under the heading "Edible Shell Notes," Mr. R. E. C. Stearns mentions a "Ten-armed Cephalopod" which he had seen offered as an article of food in the San Francisco markets. Recently, while passing through the San Francisco and Oakland markets, I found a form of a loligo lying on the stalls of the fish dealers, which they offered at twenty-five cents per pound, and which I think is the "Ten-armed Cephalopod" referred to by Mr. Stearns. Dr. Cooper informs me he had observed a shoal of loligo at Monterey, some years ago, but having no net he was unable to secure a specimen. These that we find here in the markets now are said, by the fish dealers, to be taken in nets outside the Heads by the Chinese fishermen.

The body and arms of my largest specimen measures about ten inches, the two longest arms being about three inches longer. The arms are not webbed, but each of the eight short ones have two rows of suckers their entire length, while the two other arms have a small patch of small suckers towards their tips. It took nine individuals of those I purchased from the fish dealer to weigh a pound, so we may say they weigh about two ounces each. In cleaning for cooking they will lose about half their weight, and each one will then furnish about one ounce of flesh.

In preparing them for cooking, after having removed the outer skin, pen, head, arms and entrails, they should be carefully washed, and fried in plenty of hot butter or fat, and seasoned to the taste.

Those which I had prepared and cooked were a little tough, though quite palatable, being nicely flavored, but they never will take the place of the delicious oysters and clams that have inspired poets to sing their praises.

In the form of its body and the coloring, as well as in the form ot the pen, it closely resembles *Loligo Gahi* D'Orbigny, but as I have no other material with which to compare it, and no description of that form, I cannot say definitely whether it is that species or not. This form makes an interessing addition to our west coast Cephalopods, and if upon further study I should conclude it to be new I propose to call it *Loligo Stearnsii.*

The following is a list of all the Cephalopods known to our coast, from San Diego to Alaska:

ARGONAUTA ARGO L.
OCTOPUS PUNCTATUS Gabb.
AMMOSTREPHES AYRESII Gabb.
AMMOSTREPHES GIGANTEUS Gabb.
ONYCHOTEUTHIS FUSIFORMIS Gabb.

## A NEW ASTRAGALUS.

BY SERENO WATSON.

ASTRAGALUS GRALLATOR n. sp. Perennial, the decumbent stems nearly two feet long, glabrous or nearly so: stipules distinct, acuminate-deltoid; leaves finely appressed-pubescent or glabrate, about 3 inches long; the narrowly oblong leaflets (about 20) 5 to 10 lines long: racemes loose, erect on peduncles exceeding the leaves; pedicels very slender, erect, 3 or 4 lines long: flowers small (3 lines long), pale rose-color or white; calyx-teeth narrow, shorter than the narrowly campanulate tube: pod (immature) 3 lines long, ascending upon a stipe nearly equalling the calyx, thin-coriaceous, nearly glabrous, transversely rugose, straight, 1-celled, at first compressed, becoming somewhat obcompressed-turgid, roundish dorsally and the ventral suture prominent.—At Steamboat Springs, Routt County, Colorado. Peculiar in its unusually long, slender pedicels, etc. In some respects it resembles species of the *Homalobi* section, but it is more nearly related to the *Bisulcati*, though the pod is not at all furrowed on the ventral side.

[The above Astragalus was found at Steamboat Springs in July, 1891, by the writer and sent to Dr. Watson for identification. It grew on the banks of a small stream in adobe soil, and has the odor of carrion peculiar to the Astragali that are found in similar localities. The flowers are white, but turn light pink in drying. It was a single plant, large and with many stems, and grew where *Astragalus Haydenianus* was very abundant. It was referred to in The Additions to the Flora of Colorada, Zoe, vol. ii, No. 3, as *A. Grayi.*

The manuscript was found by Mr. B. L. Robinson among Dr. Watson's papers and kindly sent to Zoe for publication.

ALICE EASTWOOD.]

# THE LOCO WEEDS.

BY ALICE EASTWOOD.

Considering how much the loco weed has been the subject of discussions, experiments and even laws, it is surprising how little is really known about its identity, its properties and its effects. A survey of what has been done by chemists and other scientists seems only to increase the confusion. They disagree upon most important points, some asserting its poisonous character and proving it by experiments while others seem to be as positive that loco poison is a superstition of the farmer and stockman.

When a botanist tries to learn from the people of different localities which plant they regard as loco, he finds that each district has its own loco weed, and he is soon at sea amid the genera and species of Leguminosæ and also of other orders of plants. However, they all firmly believe that such a weed exists and they positively know that it destroys their cattle and horses. They will generally tell the inquirer that loco means crazy, and that when a horse becomes locoed he takes every little irrigating ditch for a river and every ant hill for a mountain.

The object of this paper is not to clear the mystery by an account of original experiments or by the elaboration of new theories. To briefly set forth what has been learned, so as to form a basis for observation and research, is all that will be attempted.

Until recently, botanists have recognized only *Astragalus mollissimus* and *Oxytropis Lamberti* as loco weeds; but now *Astragalus Mortoni*, *Crotalaria sagittalis*, *Hosackia Purshiana*, *Sophora sericea*, *Oxytropis deflexa*, *O. multiflorus*, *Malvastrum coccineum* and *Corydalis aurea* var. *occidentalis*, are all under the ban. F. W. Anderson, in an article in the Botanical Gazette for July, 1889, adds *Leucocrinum montanum*, *Fritillaria pudica* and *Zygadenus elegans*. The first is common around Denver in the early spring, and is generally considered harmless to stock beyond tainting the milk of the cows that feed upon it before the grass comes.

Professor L. E. Sayre of the Department of Pharmacy of the Kansas State University, made a chemical examination of the leaves of a loco plant, which he failed to name, and his report was published in the Druggists' Bulletin, May, 1889. The results were unsatisfactory, some slight evidences of a toxic alkaloid being discovered.

Dr. Isaac Ott, in the American Journal of Pharmacy, tells of his experiments on frogs and other lower animals with an alkaloid which he obtained from *Astragalus mollissimus*. He formulates its action as follows: "1. It decreases the irritability of the motor nerves. 2. It greatly affects the sensatory ganglia of the central nervous system, preventing them from receiving impressions. 3. It has a spinal tetanic action. 4. It kills mainly by arrest of the heart. 5. It increases the salivary secretion. 6. It has a stupefying action on the brain. 7. It reduces the cardiac force and frequency. 8. It temporarily increases arterial tension and finally decreases it. 9. It greatly dilates the pupil of the eye." Professor Sayre tried the effect of a concentrated solution of this drug upon himself, commencing with a small amount but increasing to a dose of an ounce every three hours. He perceived no effects except a slight stimulation of the stomach and circulation. During the summer of 1887 and 1888 he traveled through Indian Territory, Kansas, Colorado and New Mexico, inspecting the herds, but did not find a single animal having the symptoms commonly ascribed to the locoed. Professor Sayre is strongly of the opinion that the effects attributed to loco must come from some other cause.

Dr. Mary Gage Day, in an article in the New York Medical Journal, describing a series of experiments carried on for a year and a half, arrives at a different conclusion. She made a decoction of roots, stems and leaves, and daily gave sixty or seventy cubic centimeters to a half-grown vigorous kitten while plenty of milk and other food was also supplied. She thus describes the results: "The kitten became less active, the coat grew rough, appetite for ordinary food diminished and fondness for the loco increased, diarrhœa came on and retching and vomiting occasionally occurred. The expression became peculiar and characteristic. Emaciation and the above symptoms progressively increased until the eighteenth day, when periods of convulsive excitement supervened. At times the convulsions were tetanic in character; frothing at the mouth and throwing the head backwards as in opisthotonos were marked. At other times the kitten would stand on its hind legs and strike the air with its fore paws, then fall backward and throw itself from side to side. These periods of excitement were followed by perfect quiet, the only apparent sign of life being the respiratory movements. After a short interval of quiet the convulsive movements

would recur. These alternate periods of excitement and quiet lasted thirty-six hours, when the posterior extremities became paralyzed and the kitten died about two hours afterwards. There was no apparent loss of consciousness before death. The post-mortem examination revealed the presence of ulcers in the stomach and duodenum. The heart was in diastole; brain and myelon appeared normal. As might be expected from the emaciation the entire body was anæmic."

She tried the same experiment on a vigorous full-grown cat with the same results. Two strong young cats were confined and treated exactly the same, except that one was given a decoction of loco daily. The latter became diseased while the other remained healthy. The cats acquired a decided liking for the new drink and would beg for it as for milk. To discover its effects upon an herbivorous animal she tried feeding fresh loco to a young jackrabbit that had been captured. After refusing the weed for a short time it began to relish it and eat it as eagerly as grass. In about ten days the rabbit was found dead with its head thrown back and stomach ruptured. She thinks that the plant is more poisonous in the fall and winter, after the seeds have ripened. The plants used in her experiments were *Astragalus mollissimus* and *Oxytropis Lamberti.* These are her final conclusions: "I. That there is some poison in loco weed which may cause the illness, and, if sufficient quantity is taken, the death of an animal. II. This poison is contained in the decoction obtained from the plants, and by systematically feeding it to healthy cats cases of loco disease may be produced. III. Taste for the green loco weed may be experimentally produced in the jackrabbit (an animal indigenous to Kansas). IV. From the large quantity of the plant or decoction required to produce the disease, the poison must be weak, or, if strong, it must be in a very small amount."

Dr. Day's conclusions are certainly the more convincing, for her experiments were kept up for some time; while in the other cases but few doses were given. Her methods, too, were more in accordance with the manner in which an animal on the range would become poisoned.

In 1882, 1883 and 1884 a fatal disease prevailed among the horses along the Missouri valley in Iowa, Nebraska and Dakota. Dr. M. Stalker, State Veterinarian of Iowa, discovered it to be due to *Crotalaria sagittalis.* The symptoms were similar to those produced

by the loco weeds, and upon looking for some plant allied to Astragalus or Oxytropis, he found the Crotalaria in great abundance. He had a large quantity of the green plant collected and tried to feed it to a young horse. The animal refused it, and finally he introduced a strong decoction into the stomach by means of a stomach pump. The horse exhibited all the symptoms of the poisoned animals, but recovered after a few hours. The next day he was given half as much as on the first day, and the animal died in an hour and a half. He procured another horse and gave it daily the infusion from a quart of the pods. The animal, after showing the characteristic symptoms, died on the thirteenth day.

Dr. F. B. Power and J. Cambier of the University of Wisconsin, made various chemical tests upon the Crotalaria and concluded that it contained a toxic alkaloid in small amounts. The Crotalaria caused great losses, amounting to thousands of dollars' worth of stock on some farms. The disease was marked by the emaciation so characteristic of the loco poisoning. Some animals became violently crazy, breaking through fences; but others exhibited stupor or coma, falling asleep while eating, and sometimes standing for a week sleeping most of the time with the head against some abject.

Of course, the subject of loco is more generally discussed in those states where stock-raising is one of the chief pursuits. Great losses have occurred in Colorado, particularly in the southern part. Mr. Ed. Farr, a prominent cattleman of Walsenburg, Huerfano county, Col., claims that, on an average, three hundred head of cattle are killed from loco in that county every year. Mr. E. C. Van Diest of San Luis, Costillo county, Col., writes as follows: "Fully twenty-five per cent. of the losses on cattle and horses in this section are due to loco weed. Its poisonous qualities seem to have the greatest effect from November to May. It is tempting to stock in the winter, when the grass is more or less covered with snow and its leaves surmount the snow; and also in the spring, when the grass is beginning to sprout and it is already of considerable size and conspicuous from its fresh verdure. The poison of the weed affects the nervous system, first clouding the brain and then paralyzing to a certain extent all muscular action until the animal finally dies in a state of stupor and seemingly of starvation. It begins by walking in a circle, which gradually narrows until the animal falls and expires. Though no well-fed animal will touch it, one that has happened

to eat the weed once or twice prefers it to grass, can no longer be fattened and becomes stupid and insensible to blows. Some victims indicate the spread of the disease by a sort of trembling, others become unmanageable and really crazy. The weed has no effect whatever on hogs; on sheep its effects are slight; horses seem most readily poisoned and cattle next."

The losses attributed to loco poisoning were so serious in Colorado that the legislature of 1881 passed a law to this effect: A premium of one and a half cents per pound was to be paid out of the state treasury on all loco or poison weed dug during the months of May, June and July. Each weed must be dug up not less than three inches below the surface of the ground and was to be thoroughly dry when weighed. The person who dug the weed was to produce it before the clerk of the county where it was obtained and swear that it was loco. The clerk was then to weigh the weed, burn it and give the owner a certificate setting forth in words the number of pounds of the weed, the name of the person, and that he had proved the digging up of the weed and was entitled to the premium. Upon presentation of this certificate to the county treasurer he was to be paid from the state treasury or he might pay his taxes in loco.

Considering the great number of species of Astragalus which abound in that region, so closely resembling each other that trained botanists find it difficult to surely and readily identify them, the impossibility of the ordinary county clerk accomplishing this task will be comprehended. He certainly could not examine every weed to see that the root was of the required length nor could he always be positive that every plant in the tons that were brought to him was the true loco or poison weed. How could he know when the plant was dry that it had been dug up only during the indicated months? Loco lands soon became very profitable, since a ton of loco was worth thirty dollars while the best upland hay brought only half that amount. Judging from the reports of expenditure on premiums, the supposed loco must have been brought in by the wagon load. The Mexicans were accused of planting it and caring for it assiduously. It would not be necessary to plant it, since if the roots were left in the ground, a new crop would at once begin to flourish; for loco is like alfalfa and comes up afresh whenever it is mown. Either in spite of the law or because of it the loco steadily increased

and soon threatened to bankrupt the state. Mr. Henry W. Selover of Denver, who carefully collected the facts concerning the law and its effects, gives the following table to show the result upon the revenue of the state:

| Counties. | Gener'l Revenue from 1881 to '84, inclusive. | Loco Certificates issued '81 to '84, inclusive. | Amount short. |
|---|---|---|---|
| Chaffee | $24,632 73 | $1,892 63 | ............ |
| Conejos | 18,342 65 | 18 55 | ............ |
| Costillo | 11,540 35 | 28,403 69 | $16,863 34 |
| Custer | 16,758 98 | 21,017 44 | 4,258 46 |
| Elbert | 23,768 94 | 15 00 | ............ |
| El Paso | 71,086 66 | 17,671 02 | ............ |
| Fremont | 30,741 96 | 1,588 68 | ............ |
| Huerfano | 16,946 08 | 41,748 89 | 24,802 81 |
| Las Animas | 41,344 37 | 14,063 12 | ............ |
| Park | 24,989 92 | 1,595 42 | ............ |
| Pueblo | 81,142 09 | 4,399 24 | ............ |
| Saguache | 18,221 84 | 21,142 28 | 2,920 44 |
| Total | $379,516 57 | $153,555 96 | |

The law was luckily repealed in 1885, before it had swallowed the entire state revenue. The history of this legislation is a most notable instance of the inefficiency of bounty laws. The destruction of pests can and ought to be left to those most directly concerned. Indeed, to foster rather than destroy seems the general tendency of all bounty laws.

It seems strange, with agricultural experiment stations throughout the country, that the loco question does not become settled. Much of the confusion doubtless arises from the great similarity existing among the species of Astragalus and Oxytropis. The poison, too, may not be inherent in the plant, but due to a fungus or an insect. This view would perhaps explain its prevalence during some years and in certain regions and also the constantly increasing number of new loco weeds.

For much that this paper contains I am indebted to the Rocky Mountain Druggist, which republished the articles from which I have quoted.

## SERENO WATSON.

Dr. Sereno Watson, after the death of Dr. Gray the foremost botanist of America, died at Cambridge, March 9, 1892, in the 66th year of age.

The many and important works which he has contributed to the knowledge of American Botany will form his best and most enduring monument.

## RECENT LITERATURE.

*Human Progress, Past and Future.* By ALFRED RUSSEL WALLACE. Arena, January, 1892, pp. 145–159. An attempt is being made at the present day by the followers of Prof. Weismann to apply the Neo-Darwinian theories to all departments of scientific investigation. The natural impression has existed among many scientists that an acceptance of these views would lead to a very pessimistic outlook for man's future, but Mr. A. R. Wallace in the article under consideration takes the opposite stand. He points out the two significations of the term progress, which may mean either advance in material civilization, which he believes is cumulative and continuing at the present day, or advance in the mental and moral nature of man, which he thinks may be at a standstill. He contends, as many others have done, that the great works of antiquity have not been surpassed at the present day. Thus he says: "The earliest known architectural work, the great pyramid of Egypt, in the mathematical accuracy of its form and dimensions, in its precise orientation, and in the perfect workmanship shown by its internal structure, indicates an amount of astronomical, mathematical and mechanical knowledge, and an amount of experience and practical skill, which could only have been attained at that early period of man's history by the exertion of mental ability in no way inferior to that of our best modern engineers. In purely intellectual achievements the Vedas of ancient India, the Iliad of Homer, the Book of Job and the writings of Plato, will rank with the noblest works of modern authors." More than this, Mr. Wallace thinks that the high-water mark of intellectual activity has sunk rather than risen

during the past two centuries, although the mean level may have risen. He seems to look upon human progress as advancing along one direct line, and from this point of view it might indeed seem that the high-water mark had not advanced. There is, however, another aspect of the subject. It is customary to represent the progress of life by the analogy of a tree; why not, then, look upon human progress as taking place in the same manner? According to this view the civilizations of Egypt, of India and of Greece represent the terminal buds of their respective shoots. Modern civilization started afresh from the trunk of the tree, and may indeed not yet have grown much above the tips of the old growth of Egypt or Greece; yet there can be no doubt that the new growth is a larger limb and has infinitely greater prospects of future progress.

Mr. Wallace then proceeds to consider the factors which have been operative in the past and those which may be expected to exert an influence on the future advance or deterioration of mankind. He shows how the warfare of tribe with tribe has destroyed the weaker, while the greater vital energy of higher races frequently causes the extinction of the lower. Still more powerful than this warfare of one tribe with another is the survival of the fittest among the individuals of a single tribe. "On the whole," says the writer, "we cannot doubt that the prudent, the sober, the healthy and the virtuous live longer lives than the reckless, the drunkards, the unhealthy and the vicious; and also that the former, on the average, leave more descendants than the latter." He asserts that this process ot elimination will raise the mean level, but very properly adds that "it can have little or no tendency to develop higher types in each successive age; and this agrees with the undoubted fact that the great men who appeared at the dawn of history and at the culminating epochs of the various ancient civilizations were not, on the whole, inferior to those of our own age." (p. 149.) This is, however, a very remarkable passage for Mr. Wallace to pen, for he has here virtually given up his customary Neo-Darwinian stand. If the process of natural selection or elimination cannot develop higher types of man by the selection and accumulation of already existing variations, how indeed can natural selection produce higher types of animals, as Mr. Wallace claims, by the selection of fortuitous variations? But he forsakes this position in another place. How, indeed, can the passage just quoted be made to harmonize with the

following: "When this average rise has been brought about there must result a corresponding rise in the high-water mark of humanity; in other words, the great men of that era will be as much above those of the last two thousand years as the average man will have risen above the average of that period. For those fortunate combinations of germs which, on the theory we are discussing, have brought into existence the great men of our day, will have a far higher average of material to work with, and we may reasonably expect the most distinguished among the poets and philosophers of the future will decidedly surpass the Homers and Shakespeares, the Newtons, the Gœthes and the Humboldts of our age." (p. 158.)

In no possible way can these two passages be reconciled. He first asserts that natural selection has raised the mean level of humanity but cannot raise the high-water mark, and follows this by another passage in which he says that the elevation of the mean level will furnish a higher class of material for germ combinations to work upon in the origination of a higher type of genius.

Mr. Wallace briefly discusses the theory of the isolation of the germ-plasm, which carries with it the non-inheritance of acquired characters. Education, according to this view, cannot have any direct effect upon human progress. The writer argues that if educational influences could be transmitted it would be reasonable to expect that there would be a progressive improvement in the families of men of genius from generation to generation. He cites a considerable number of notable instances where this was not the case, however. Thus he says: * * * "we find that Dollond, the inventor of the achromatic telescope, was a working silk weaver, and a wholly self-taught optician; Faraday was the son of a blacksmith, and apprenticed to a bookbinder at the age of thirteen; Sir Christopher Wren, the son of a clergyman and educated at Oxford, was a a self-taught architect, yet he designed and executed St. Paul's Cathedral, which will certainly rank among the finest modern buildings of the world," etc. All of which may be perfectly true, but one is tempted to stop before completing the list and ask Mr. Wallace if he has forgotten the fact that all these men had mothers. Genius is a very unstable commodity and once the nice adjustment of mental traits by which it was brought about is disturbed by the introduction of a new element the whole organization is apt to be upset. Mr. Wallace might have continued with an enumeration of the sons of men of genius who have been worthless or insane.

The writer combats the view that the non-inheritance of educational culture is a bar to future progress. He goes even further and considers that it is a positive boon to humanity that such culture cannot be inherited. In order to do this he is obliged to take a most uncompromisingly pessimistic view of the present. "If it is thought," he says, "that this non-inheritance of the results of education and training is prejudicial to human progress, we must remember that, on the other hand, it also prevents the continuous degradation of humanity by the inheritance of those vicious practices and degrading habits which the deplorable conditions of our modern social system undoubtedly foster in the bulk of mankind. Throughout all trade and commerce lying and deceit abound to such an extent that it has come to be considered essential to success. No dealer ever tells the exact truth about the goods he advertises or offers for sale, and the grossly absurd misrepresentations of material and quality we everywhere meet with have, from their very commonness, ceased to shock us. Now, it is surely a great blessing if we can believe that this widespread system of fraud and falsehood does not produce any inherited deterioration in the next generation." There are many who would disagree with Mr. Wallace as to the universality of evil at the present day. Surely there is much less of evil now than in even comparatively recent past historical times. But even granting all that he requires of us, there must, according to his own views, be a time in the future when good will preponderate, at which time it will be as great a disadvantage that acquired virtue cannot be inherited as it now is an advantage that acquired vice cannot be. Yet another objection. According to the writer's views, the evil which he deplores in the present must be innate and due to the inherent properties of the germs, in which event it must be as easily transmitted, or indeed far more easily, than could an acquired character. This evil in man's nature which he sees may in fact be fostered by pernicious social institutions, but it must exist before it can be fostered, and if acquired characters cannot be inherited it must be inherent in the organism.

It may be of interest to inquire what Mr. Wallace considers to be the real factors of future progress. There are two such factors, he says. "The one is that process of elimination already referred to, by which vice, violence and recklessness so often bring about the early destruction of those addicted to them. The other, and by far

the more important for the future, is that mode of selection which will inevitably come into action through the ever-increasing freedom, joined with the higher education of woman." This second must indeed be a factor of great importance, it would seem, although by no means the only one. Selection of the best existing cannot alone produce anything better than the best. C. A. K.

*The Auk* for January, 1892, contains nothing of special interest to the Pacific Coast. The supplement containing the address by the president, Mr. D. G. Elliot, on The Inheritance of Acquired Characters, is a timely and interesting discussion of this vital problem in biology, and deserves a careful reading. The closing words of the address are especially worthy of consideration by our American ornithologists. "The subject I have discussed offers a new field for ornithologists to explore: one of a higher plane, and permitting a wider vision than many of those they are accustomed to tread. I submit it to my younger colleagues, who have time and opportunities before them, as of infinitely more importance than the discovery and naming of new forms, which is by no means the beginning and end of ornithology, but rather, if I may so term it, the A B C of the science; and then, by their contributions towards the elucidation of my theme, they will benefit not only those who are devoted to our own branch, but also scientific men throughout the world." His arguments would have had more weight if they had not been stated from so obviously a partisan standpoint. Some of the instances which he gives in proof of the inheritance of acquired characters may be equally well explained in other ways, and hence are not conclusive. C. A. K.

*A Preliminary Study of the Grackles of the Subgenus Quiscalus.* By FRANK M. CHAPMAN. Bull. Am. Mus. Nat. Hist., iv, 1–20. The subgenus Quiscalus has always been known as a puzzling group of birds, but the real complexity of the inter-relationship of the different forms was probably not fully realized before the appearance of Mr. Chapman's comprehensive review. Although 845 specimens were examined, this material was found insufficient to complete the study of the group. Certain questions of vital importance are, however, apparently settled. The three forms, *Quiscalus æneus*, *Q. quiscula*, and *Q. quiscula aglæus*, are carefully described, and in a summary a brief diagnosis of each form is given, including

each of the three phases of *quiscula*. The variations of each form are then carefully followed throughout their breeding range, and the general conclusions as to relationship stated. The two most important conclusions are that—" In the Alleghanies of Pennsylvania, in the Hudson Valley from Sing Sing to Troy, in eastern Long Island, in Connecticut, and in Massachusetts as far north as Cambridge, *quiscula* and *æneus* completely intergrade"; and that—" This intergradation is in every instance accomplished through phase No. 3 of *quiscula*."

Mr. Chapman then argues very reasonably that *quiscula* is a distinct species, and not a race of *æneus*. If this be not the case, he asks why *æneus* should remain so perfectly constant over an immense area and then change into three different forms. It is, at least, impossible to see any environmental influence which could have produced such a modification as this, and the matter accordingly becomes inexplicable upon any theory except hybridity.

Although Mr. Chapman has established by his careful investigation at least the great probability that hybridization is the rule among the grackles, he is hardly justified in extending this to other species. Thus he says: "Nor do I see any good reason why we should refuse to admit hybridization as a factor in the evolution of what we term species. * * * Difference in habit under what must necessarily be similar conditions will ever be an effectual barrier against the indiscriminate mixing of even closely-allied birds. But when two species whose natural economy, song, nidification, etc., are the same, and which agree in structural details and differ only in coloration, inhabit contiguous regions, is it unnatural that they should at first occasionally, and in the end regularly, interbreed? The evidence in proof of such intergradation is gradually accumulating, and in the future I think we shall be forced to recognize hybridization, not only as a means which unites known forms, but which also gives rise to new ones."

The writer has apparently overlooked, in the above passage, the possibility of physiological selection interposing a barrier to hybridization, even when the two species appear to be structurally identical. If the theory of physiological selection is to have any validity whatsoever, it is necessary to assume that such cases of habitual hybridization as are occasionally recorded, are exceptional and abnormal. To be sure, it may be objected that this is arguing from

theory to fact, but then a good and useful theory should not be too lightly discarded. C. A. K.

*The North American Species of the Genus Colaptes, considered with Special Reference to the Relationships of C. auratus and C. cafer.* By J. A. ALLEN. Bull. Am. Mus. Nat. Hist., iv, 21–44. In the present paper Mr. Allen has undertaken a most careful and thorough investigation of the remarkable intergradation existing between *Colaptes auratus* and *C. cafer*. His report is based upon the examination of 785 specimens of the genus from North America and the West Indies, representing all the known species and varieties inhabiting this region. The relationship of the two species under consideration is first discussed, and the characteristics and distribution of the various races given. More detailed attention is then devoted to the intermediate birds, the conclusions arrived at with regard to them being stated as follows: "The facts elicited in the present investigation tend strongly to confirm Baird's startling hypothesis of hybridization on a grand scale between *Colaptes auratus* and *C. cafer*, to account for the occurrence of birds presenting ever-varying combinations of the characters of the two species over the Plateau and Great Basin regions of the continent. None of the other hypotheses thus far advanced so fully, or, in fact, to any great extent, meet with the requirements of the case. In no instance do we meet with stages or methods of geographical variation at all comparable with what is seen in the case of *C. auratus* and *C. cafer*. The transition between geographic forms, however diverse, is gradual and symmetrical, affecting all parts of the plumage equally and simultaneously, and is obviously correlated with changes in the physical surroundings; also, the differences between the most extreme forms are merely differences of degree. In the case of Colaptes, the essential differences between *auratus* and *cafer* are radical; they are, in fact, contrasting characters, and the intergradation is irregular, with all sorts of a symmetrical combinations of the characters of the two forms, and no correlation between their intergradation and the conditions of environment."

Mr. Allen has, in fact, practically demonstrated the habitual hybridization of these two species, as Mr. Chapman has just succeeded in doing for the grackles. The bearing of this demonstration upon the infertility of crosses and the relation of color to sterility, as discussed by Wallace in "Darwinism," is very important, placing the

subject in a somewhat new light. The facts do not seem to bear out Mr. Chapman's suggestion, however, that hybridization may be a means of originating new species, for, in the present instance, the tendency seems to be rather to merge two existing species into one. C. A. K.

*The Geographic Distribution of Life in North America*, with special reference to the Mammalia. By C. HART MERRIAM, M. D. Proc. Biol. Soc. Washington, vol. VII, pp. 1–64. Fauna No. 3 of the Department of Agriculture was an epoch-making work in the literature of the geographical distribution of animals in America. Dr. Merriam, in the present work, has amplified and systematised the ideas which were there first enunciated. With the unequalled facilities at his command in the shape of probably the largest and most discriminatingly collected series of mammals that has ever been made from the same extent of territory, he is in a better position than any of his predecessors to draw conclusions with regard to the distribution of life in North America.

The paper commences with a historical synopsis of the faunal and floral divisions proposed for North America by various writers. Each division is considered separately, with a chronological table of the work of different writers upon it. The different life regions are then discussed with reference to the mammals inhabiting each. Considerable space is devoted to the causes controlling distribution and in combating certain of Wallace's views. Dr. Merriam is especially pronounced in asserting the importance of temperature in directly affecting the distribution of animals, and his answer to Wallace with regard to the change in mammalian forms from the north southward is very forcibly put. The general drift of his paper is, that life zones are largely climatic, and consequently extend in belts more or less parallel to the equator rather than in a north and south direction, as claimed by Wallace.

In closing, he says: "Wallace, in writing of the principles on which zoological regions should be formed, expresses the opinion that 'convenience, intelligibility and custom should largely guide us.' But I quite agree with America's most distinguished and philosophic writer on distribution, Dr. J. A. Allen, that in marking off the life regions and subregions of the earth, truth should not be sacrificed to convenience; and I see no reason why a homogeneous circumpolar fauna of great geographic extent should be split up into primary re-

gions possessing comparatively few peculiar types, simply because a water separation happens to exist in the present geologic period; nor is it evident why one of the resulting feeble divisions should be granted higher rank than a region of much less geographic extent comprising several times as many types." C. A. K.

*Wood Notes Wild.* Notations of Bird Music, by SIMEON PEASE CHENEY. Collected and arranged with appendix, notes, bibliography, and general index, by JOHN VANCE CHENEY. It has been the fashion of scientific ornithologists to pass over the songs of birds as something unworthy of their serious attention, contenting themselves with occasional vague phrases descriptive of bird notes introduced in their lighter writings. The cause of this is not that bird songs are of no scientific importance, but that it is almost impossible to record them in a manner sufficiently accurate to reduce their study to a science. There is no reason why the phonograph might not be brought into use for this purpose; but in the absence of any such investigations as this, the work of Mr. Cheney cannot fail to prove a great benefit to this much neglected corner of science. It remains for future investigators to verify the accuracy of his musical notations; but in view of the fact that he was primarily a musician, and at the same time an accurate and painstaking observer and an enthusiastic admirer of birds, there is every probability that his interpretations are in the main correct.

As a foundation for the future study of bird notes, the value of this work cannot be overestimated. The typical songs and many of the variations and call notes of all the more common Eastern birds are recorded in musical scale with text descriptions and amplifications.

Much of this music has been published in the magazines, but Mr. John Vance Cheney has done more than make a collection of his father's work in the present work. Over half the book is devoted to an appendix, in which are incorporated all the most important descriptions and notations of bird music which have been published by other writers, with much other matter bearing more or less directly on the question under consideration. A very full bibliography of the subject closes the work. C. A. K.

*The American Naturalist.* October, 1891.—Notes on the Hearts of Certain Mammals: By Ida H. Hyde. Brief notes on points of

interest regarding the hearts of sheep, cat, man, monkey, panther, raccoon, hyena, dog, deer, calf, horse, donkey and rabbit.

November, 1891.—Language and Max Müller: S. V. Clevenger, M. D. A criticism of Müller's attitude with regard to the evolution of language. The writer says: "Throughout Max Müller's writings he is handicapped by his exaggeration of the importance of his particular line of research, carried on as an isolated study. Could he but have a fair knowledge of associated sciences, such as that of anthropology, anatomy, physiology and zoology, the value of his work would be greatly increased, and his inferences would undergo radical changes." On the Quantity and Dynamics of Animal Tissues: J. Lawton Williams. Recent Progress in the Discovery of the Phylogeny of Man: Editorial. The discovery of skulls verifying the supposition that a race of people inhabited Europe with skulls similar to that of the Neanderthal man, is noted. Also, of two nearly complete skeletons, of which they say: "Taking it altogether, the Canstatter race answers the expectations founded on theory as to what an ancestral type of man ought to be." Professor Cope also finds confirmation for his theory that the anthropoid apes and man were descended from the anthropoid lemur Anaptomorphus, without passing the intervention of the old world monkeys. C. A. K.

*The Ibis*, for January, 1892, contains among articles of general ornithological interest, a list of the birds of Heligoland as recorded by Herr Gätke, by Henry Seebohm; Some further Notes on the Periods occupied by Birds in the Incubation of their Eggs, by William Evans, F. R. S. E.; and the fourth part of the Rev. James Sibree, Jr.'s, paper, On the Birds of Madagascar and their Connection with Native Folk-lore, Proverbs and Superstitions. C. A. K.

HARALD SCHÖTT, of the University of Upsala, Sweden, has published: *Beiträge zur Kenntniss Kalifornischer Collembola*, mit 4 tafeln in Bihang Till K. Svenska Vet.-Akad. Handl. Bd. 17, Afd. iv, No. 8.

Collembola are minute Thysanuræ, or wingless insects, which live under leaves and stones, and propel themselves by jumping. The work is a very interesting one, as very little is known about these small animals in any part of the world. The material was collected in California by Dr. Gustav Eisen, and forwarded to the author for

description. The following species are described, five of which are new: *Sminthurus Eisenii*, n. sp.; *S. luteus Lubbock; S. niger Lubbock; S. plicatus*, n. sp.; *Papirius maculosus*, n. sp.; *Tomocerus* sp.; *Entomobrya nivalis* L.; *E. multifasciata* Tullb.; *E. marginata* Tullb.; *Sira purpurea*, n. sp.; *Drepanura californica*, n. sp.; *Orchesella rufescens* Lubbock; *Isotoma viridis* Bourl; *I. palustris* Müller; *Achorutes armatus* (Nicolet); *A. viaticus* Tullb.; *Xenylla maritima* Tullb.; *Lipura inermis* Tullb.; or, in all, about 18 species. The paper is handsomely illustrated. G. E.

*Revisio generum plantarum vascularium omnium, atque cellularium, multarum, secundum leges nomenclaturæ internationales, cum enumeratione plantarum in itinere mundi collectarum. Mit Erlauterungen* von DR. OTTO KUNTZE.

This book is likely to serve a most useful purpose—it shows to what extent zeal without discretion may carry a reformer, and incidentally may make clear to a few American botanists, ardent makers of synonyms, their inability to cope in such matters with those who are able at any time to consult the great libraries of Europe.

Dr. Kuntze, in his journey round the world, collected a few thousand species, and in working them out to his satisfaction, changes about thirty thousand names. The means by which he arrives at this result is the rather radical one of taking for his point of departure an earlier work of Linnæus than the one generally adopted.

Another method of changing genera which he uses with considerable effect is the substitution of older sectional, for more recent generic names. This though the logical outcome of the practice of some American botanists in the matter of varietal names is as repugnant to common sense as a claim of priority founded on the distribution of named sets.

The license, which the author allows himself, of modifying (correcting as he terms it) generic names, is not likely to meet with acceptance. The principle of priority will appear to most persons to be as absolutely overthrown by substituting Cumaruna, Catutsjeron, etc., for Coumarouna, Katoutsjeroe, etc., as by making entirely new names. The principle is the same, the violation differs only in degree, and the inconvenience resulting from the alterations in indexing is the same.

A considerable number of his generic changes will probably be concurred in, though not in the scrambling manner in which they

are launched by the author; but his wholesale transference of the species of a thousand genera, many of them of great extent, can only be considered an instance of colossal vanity, which will go far to convince botanists of the value of the zoological rule. It is impossible to assign any other reason than the gratification of personal vanity to the author's addition of "OK." to all the species of such genera as Astragalus, Selaginella, Lepiota, Corticium, etc., the value of which species he could not possibly know. It is an amusing circumstance that in America the abbreviation with which his pages is so plentifully besprinkled is a slang expression in common use, said to have had its origin in indorsements on papers submitted to an eminent politician, who was as lawless in orthography as our author has proved himself in botany. When questioned as to its meaning, he explained that it meant "Oll Korect."

It is to be hoped that in giving new names to his genera he did not act from a malicious desire to render the recipients of his favor ridiculous. Such names as "Bakeropteris," "Bisbœckelera," "Biscogniauxia," "Brittonamra," "Cookeina." "Durandeeldea," "Greeneina," "Henribaillonia," "Jacksonago," "Jamesbrittenia," "Peckifungus," "Radlkoferotoma," "Sirhookera," "Sirmuellera," "Smithiantha," may look well to his eyes and sound agreeably in his ears, but his taste is likely to be unique.

Among the numerous changes which, if adopted, would affect our Californian plants, may be mentioned Buda, which the author adopts instead of Tissa, because the latter remained longer a "nomen nudum;" but with a degree of inconsistency for which one would have hardly looked, he shortly after adopts Meadia instead of Dodecatheon, transferring all the "species" (of whose value he is necessarily absolutely ignorant) to a genus which remained "naked" till his day—that he might attach "OK." to the species.

Agoseris, which he accepts in place of Troximon, is in similar case according to Mr. Greene the devoted disciple of Rafinesque, for all the species are claimed by Mr. Greene in "Pittonia," which of course he could not do if there were a type species. Dr. Kuntze nevertheless, having apparently kept the scope and intention of his work entirely secret, renames the species under the same date as Mr. Greene, but of course attaches "OK." to all of them. A similar muddle results from the equally inexcusable renaming of Leguminous species by Dr. Taubert in Bot. Centralblatt, September, 1881.

We have therefore in these cases and probably many others, two sets of synonyms, the priority of which will be extremely difficult to prove should it ever be necessary to do so.

Navarretia, which has priority over Gilia, has also the refreshing novelty of a type species; for the number of genera in which all the species are credited to "OK." becomes monotonous. As to the changes involved by calling Lepidium, Nasturtium; Ionidium, Calceolaria; Gouania, Lupulus; Phlox, Armeria; Cortinarius, Gomphus; etc., we fear the author's life will not be long enough to see them made.

The changes in nomenclature are not confined to phanerogamic botany, but cover the whole range of the vegetable kingdom, and wholesale changes are made quite as coolly in fungi, the genera of which are notoriously in a transition state, as in the more settled orders. It is to be feared that Cryptogamic botanists will consider the author guilty not only of folly but of impertinence as well..

As the author has done little in studying the values of genera, the changes in specific names are comparatively few. He shows a tendency to reduce genera, and though there is a sufficient field for the exercise of such a spirit, it may be doubted whether he has selected the most promising examples.

He argues at length and with considerable feeling against the changing of specific names, and most botanists will agree with him; but he might have gone much further and shown how improper and unnecessary it is to change them at all, except in monographs of families—else why the third name attached to species? In the work of botanists who accept the zoological rule, and they are numerous and increasing, the cited name furnishes a means of distinguishing the species until the monographer can deal with them. Mr. Hemsley, for instance, in listing the Mexican species of Dalea,* evidently recognizing the fact that he was unable to judge of the validity of the species with the material at hand enumerates—

20. *Dalea elata* Hook. & Arn.
21. *Dalea elata* Mart. & Gal.,

and the future monographer of the Leguminosæ will be able to distinguish them and decide on their merits just as well as if one of them had been afflicted with the name *galeottiamra*.

* Biol. Cent.-Am. i, 239.

The sooner any botanist of our day divests himself of the idea that he is likely to live to see a settled nomenclature, or that the rest of the botanical world will allow some fifth-rate authority to attach his name to the work of all the great men who have preceded him, the sooner we shall be able to argue out generic questions without lugging all the species in by the ears, and so adding immensely to our synonymy.

The reason for such extensive changes without study of the species, can only be the belief of an author that his judgment will finally settle the nomenclature, and the fact that these wholesale transferences are made almost entirely by those who attach the last combiner's name furnishes the strongest proof of the motive. Whatever fault may be found with Bentham and Hooker for their work in "Genera Plantarum" they must be commended for their modesty, for on the line followed out by Dr. Kuntze they might have attached B. & H. to an immense number of species, with no greater trouble than that involved in the employment of an additional copyist.

It should not be forgotten by botanists in haste to settle nomenclature, that there are two questions hanging over systematic biology of such importance as to cast Dr. Kuntze's modest contribution to synonymy entirely into shade. The first of these is homonymy as between zoology and botany, a question which can only be settled by agreement between the great body of zoologists and botanists. The second, the limits of genera, we may all help to solve. About species there is often a considerable divergence of honest opinion, which time and better knowledge will be apt to reconcile, but genera should be more easily settled. It ought to be possible to make to some extent rules as to what should and what should not be taken into consideration, especially as long as genera are to a great extent matters of convenience. Undoubtedly the tendency is to make them more strictly natural, and great modifications are likely to result particularly in such families as Compositæ, Caryophyllaceæ, Acanthaceæ, etc., in which they are now extremely artificial. A little logic injected into systematic botany might enable us, for instance, to see that if its various sections can be properly included in the genus Quercus, there can be no sufficient reason for holding Castanopsis distinct from Castanea or Carya from Juglans. The theory that the limits of genera and

species can best be determined by a kind of individual "insight" without any rule whatever, has had a long trial and the heterogeneous results are hardly encouraging. [K. B.

*Monograph of the Grasses of the United States and British America.* By DR. GEORGE VASEY, Botanist, Department of Agriculture. Pamphlet, 8vo pp. vi, 89, xiv.—This is No. 1, of vol. iii, of the "Contributions from the U. S. National Herbarium," and is "published by the authority of the Secretary of Agriculture." This part closes with the family Agrostideæ.

The author states that for several years he has had in contemplation the work here presented. Every one knows of the great wealth of material—necessary for the preparation of such a work—contained in the National Herbarium. Collections of grasses from all parts of North America have been coming to this herbarium for a long time past, and these additions have been especially frequent in recent years. Liberally supplied with books and assistants, and otherwise very generously supported by our National Government, the Botanist of the Department has had unrivalled facilities for the production of the present "Monograph."

The work before us comes far from meeting our expectations. It is entirely lacking in that clear, precise and systematic presentation of facts which stamp the work of the true scientist; and instead of being a "Monograph," it is very largely a compilation—a bringing together of scattered descriptions, some of which are quoted and duly credited, some quoted "with a little alteration" (mangled, would better express it), and some quoted without any recognition of the source whatever; and these last form no inconsiderable portion of the whole. This frequent quotation of descriptions published by various authors renders the whole thing incongruous, not only in the relative length and character of the descriptions given, but in the terminology. If the original descriptions of the species had been copied instead of those published by later authors, and a proper system of references adopted, the value of the work would have been increased.

*Setaria viridis* and *S. glauca*, on p. 38 of the "Monograph," do not appear to possess very marked distinguishing characters.

*Stipa Stillmani*, on p. 51, is rendered as follows: "*S. Stillmani* Bolander. (Bot. Cal. ii. p. 287)." Then follows Dr. Thurber's description of this species, word for word, excepting that the floret is

said to possess a "white, hairy callus," instead of a "white-hairy callus," as Thurber wrote it, and there is nothing to indicate that it is not all original. One would naturally infer from the above, however, that Bolander published this grass in the Botany of California, which was in fact not the case.

The description of *Stipa leucotricha*, on p. 53, is but a translation of that given by Trinius and Ruprecht in their joint work usually cited "Stipaceæ," not "Gram. Agrost.," as appears in the work before us.

On p. 55 *Stipa Richardsonii* Link is described and there is given the reference in parenthesis, "(Gray's Manual, 6th ed., p. 641)." This amounts to a statement by the author that he is describing the same plant as that described by Gray in the 6th ed. of the Manual, but he states below that his description applies to the "large form which Prof. Macoun called var. *major*, and is perhaps specifically distinct from the form which is found on Lake Superior" (where on the lake is not specified) "and eastward." We all know that it is this eastern form which is "perhaps specifically distinct" from the other, that is described in the Manual.

Did Smith describe *Polypogon littoralis* in the Botany of California? We might very justly presume so from the way the name and description stand on p. 57. And why is it that quotation marks enclose the descriptions of *Polypogon Monspeliensis* and *P. littoralis*, and not that of *P. maritimus?* Is it because there were no specimens of these plants in the National Herbarium that the monographic character of the work was thus marred by scissors and paste? The descriptions of *Sporobolus compressus* and *S. serotinus* are taken entire from Gray's Manual, and one might be led into the error that the last named species was first described by Gray in the 6th edition of the Manual.

On p. 80, there seems to be some confusion as to *Calamagrostis dubia*. It is described as a species, and also presented as a var. of *C. Canadensis*.

There is nothing in the descriptions indicating the differential characters of allied species, and rarely are there any comparisons drawn. Carefully describing one organ or a part in one species and saying nothing about this in the next in sequence is far too common a feature in existing descriptions of our plants, and leads the student into a world of tribulation. A close attention to this point

in the preparation of monographs would, we think, somewhat reduce the number of our species, especially in Gramineæ. In this connection we might call to notice the descriptions of *Alopecurus Howellii* and *Alopecurus Macounii*, in the present work (pp. 87 and 88).

The assistance afforded by the translation of "The True Grasses" in the preparation of the analytical tables is acknowledged in the Introduction, and thanks are returned to Prof. Hackel for the privilege of using this work, although the translation is an American production and copyrighted by the publishers.

There are a number of "slips" which might trouble or confuse the student. We are told on the first page that the floral organs, the palet, the lodicules and the floral glume, "constitute a spikelet." Only the first glume in the Andropogoneæ is said to be "more indurated than the inner ones." Over Oryza, on p. 4, the empty glumes are described as "awnless, the flowering glume and palet much compressed laterally." These characters are supposed to enable us to distinguish Oryza from Leersia, which follows, and which has "flowering glumes awnless;" we are not told whether the glumes are compressed or not. In the tribe Oryzeæ, the empty glumes are said to be "two or none, very seldom numerous." Hackel says "empty glume two or more, very seldom numerous." In most of our species of this tribe the empty glumes are wanting. The grain in Sporobolus (p. 5) is characterized as "loosely enclosed or naked." On the same page the flowers of Epicampes are said to be "large" and "not awned."

In this first part some twenty species are described for the first time, and a few of these are characterized as new.

We hope that greater care will be exercised in the preparation of the second part, which the author hopes to publish "within a few months." In the Introduction, criticisms are invited, and we only regret that a work so excellent in its object should be so open to criticism. If through what has here been said, the character of part 2 reaches a higher plane, we shall only be too glad to publish the fact. F. LAMSON SCRIBNER.

*Fossil Botany: Being an Introduction to Palæophytology from the Standpoint of the Botanist.* By H. GRAF ZU SOLMS-LAUBACH, Professor of Botany in the University of Strasburg. *Authorized English Translation.* By HENRY E. F. GARNSEY, M. A. Among re-

cent botanical works it would be hard to find one which is more welcome to the student than the one before us. The original was published in Germany, in 1887; and now we have an admirable English translation issuing from the Clarendon press, to which we owe so many excellent translations of standard German botanical works.

The literature of palæophytology is so scattered as to be practically inaccessible to the general botanist; and, moreover, a great part of it is the work of men who are not botanists at all, the result of whose works is an appalling mass of fragmentary and often utterly unreliable material. Count Solms not only has won a high reputation as a palæophytologist but has also done excellent work in other departments of botany, and, as a thoroughly trained botanist, is eminently fitted for the task he has so admirably performed in the volume before us. To him we owe a careful resumé of what has been done up to the time of publication of his book, and a thorough sifting of the material thus brought together. He is extremely cautious in his judgments, and often suspends judgment entirely; but where he makes a positive statement one is sure that it is based upon adequate evidence. As the result of this careful examination, many forms, usually accepted by palæophytologists, are thrown aside as resting upon imperfect evidence, and, in consequence, one's ideas of the nature of many of the fossil forms are materially changed.

An introduction of some thirty pages deals largely with the conditions under which plant remains have been preserved in a fossil state, and includes an able discussion of the formation of peat and coal beds. The Thallophytes and Bryophytes are disposed of in a single chapter, and the rest of the book is devoted to a consideration of the lower vascular plants—Pteridophytes and Gymnosperms. The Coniferæ are treated first for reasons thus given by the author: "In departing from the customary arrangement * * * we have been influenced chiefly by practical considerations, for the adoption of this order will facilitate the discussion of the many doubtful forms which belong to one or the other of these classes, but which it will be best to consider in connection with similar groups of the Archegoniatæ." A chapter is devoted to the group, and the author seems to think that there is not sufficient evidence to warrant the assumption that conifers of the modern types existed

anterior to the Mesozoic. The remains occurring in older formations, and usually attributed to this class, are either too imperfect to permit of certain classification, or may better be referred to other groups. Of living genera Araucaria is certainly known as far back as the Jurassic, and Sequoia as the Cretaceous; Ginkgo is still older.

A special chapter is devoted to the Cycads and Medullosæ, and another to the remarkable entirely extinct group of the Cordaiteæ. To the latter. which are separated entirely from the Coniferæ, are referred many of the remains of fossil wood which have usually been supposed to belong to the Coniferæ. The most interesting point in connection with them is the discovery of flowers, both male and female, in a sufficiently perfect state of preservation to give a very fair idea of their structure, which differed materially from that of any living gymnosperms. The pollen grains are preserved with remarkable perfectness, even showing a group of cells within which is assumed to be a sort of rudimentary prothallium like that in the pollen of other gymnosperms, but much more highly developed. These points seem to warrant the separation of the Cordaiteæ as a class, co-ordinate with the Cycads and Conifers.

The chapter on the ferns is especially interesting and suggestive. While a considerable number of ferns have been found with well preserved fructification, all of these in the formations below the Mesozoic, that can be positively determined, show affinities with the Marattiaceæ and, perhaps, with the Ophioglosseæ. This fact is especially significant, as it entirely reverses the ordinarily accepted arrangement of the leptosporangiate and eusporangiate ferns. The former—*i. e.*, those ferns in which the sporangia are of strictly epidermal origin—are usually regarded as the simpler forms from which the Eusporangiatæ, or those forms with massive sporangia, like the Marattiaceæ and Ophioglosseæ, have been derived.

As the Leptosporangiatæ have firm sporangia that ought to have been preserved in a fossil state, it is difficult to account for their absence from the coal measures and earlier formations, if they really existed when these were forming. It seems probable that they are really later, more specialized forms, derived secondarily from the more primitive Eusporangiatæ. This view accords, too, with the evidences of embryology, and simplifies very much the problem of the origin of the phanerogams. The remains of hydropterides are very scanty, and only a few remains from the tertiary are beyond dispute.

Lack of space forbids our dwelling upon the very full account of the characteristic groups of the Calamarieæ, Lepidodendroideæ, Sigillarieæ and Sphenophylleæ. The first, which are usually supposed to show unquestionably near relationship to Equisetum, are shown to be much more imperfectly understood than was supposed, but for the details of the discussion the reader must be referred to the work in question. It is rather unfortunate that the angiosperms are not treated, as it would be extremely interesting to hear the author's views upon the origin of the group, as well as to have the data upon which to work for one's self.

The translation of the book and the typography are alike admirable, but it is a pity that it was not revised up to date, as several important works have appeared since the original was written. By a curious oversight this lack of revision was carried even to the title-page, where we are informed that the author is professor at Göttingen, although he succeeded De Bary at Strasburg more than three years ago. D. H. C.

*Outlines of Lessons in Botany for the use of Teachers, and Mothers Studying with their Children.* By JANE H. NEWELL. Part II. Flower and Fruit. The author of this little volume is an enthusiastic teacher, imbued with the spirit of modern science. The children are to study the plants themselves, so as to become original observers and thinkers instead of the "intellectual parasites" that so generally disgrace our schools. They are to be led to draw the parts of the flower, etc., united and separated, and in different sections. The correct botanical terms are to be learned as the necessity arises for their use. One of the most valuable features of the work consists of numerous suggestions for investigation into the habits of plants, particularly concerning the fertilization of flowers. Even quite little children may discover treasures of knowledge in this almost unexplored field. The study will become interesting and inspiring with such an incentive to patient, careful observation.

That the plants studied are chiefly those of New England, would make no difference to anyone but a rote teacher. It is the method illustrated by these studies that gives the book its great value as an aid to the teacher who is striving for the true education of pupils.

A. E.

*The Identity of Asclepias stenophylla and Acerates auriculata.* JOHN M. HOLZINGER. Bot. Gaz., Apr., 124. Mr. Holzinger having made careful study of the various forms of those plants, considers them mere variations of the same species, and unites them under the oldest available specific name, *Asclepias auriculata* (Engelm.). Studies of this kind are of much more importance than dozens of barely distinguishable "new species." K. B.

## PROCEEDINGS OF SOCIETIES.

CALIFORNIA ACADEMY OF SCIENCES. *February 1, 1892.* President Harkness in the chair.

The Librarian reported 153 additions to the library.

Charles A. Keeler read a paper on "Heredity in its Relation to the Inheritance of Acquired Characters."

*February 15, 1892.* President Harkness in the chair.

Donations to the museum were reported from Charles A. Keeler, H. Abbott, Herbert Brown, E. D. Flint, Miss Louise A. Littleton, Geo. B. Badger, Charles N. Comstock, Charles Hubbard, T. B. Sanders, George W. Dunn, William G. Blunt, Walter E. Bryant.

The Librarian reported 160 additions to the library.

Dr. Gustav Eisen read a paper entitled: "The Evolution of the Forms of Trees as Produced by Climatic Influences."

*March 7, 1892.* President Harkness in the chair.

Donations to the museum were reported from W. S. Bliss, Gustav Eisen, T. B. Sanders.

Letters were read announcing the donation to the herbarium of a collection of Greenland plants by John H. Redfield, and of a package of specimens of Sphagna of the northeastern United States, by Edwin Faxon, and a vote of thanks was tendered to each of those gentlemen.

Charles A. Keeler read a papcr entitled: "Is Natural Selection Creative?"

Dr. Harkness exhibited specimens of the Cynips which is now so abundant in Golden Gate Park, also of the galls from which they are emerging, and made some remarks on their life-history.

*April 4, 1892.* President Harkness in the chair.

The President announced the death of Sereno Watson, honorary member, and of William A. Aldrich, resident member.

The Librarian reported 222 additions to the library.

Dr. Harkness made some remarks concerning his observation on the life-history of the Cynips infesting the oaks, and discussed the probability of the one attacking the buds being an alternate generation of the one forming the woody galls.

F. Gutzkow spoke on certain improvements in his process for parting silver bullion, which he explained to the Academy about a year ago. He stated that it has now been introduced successfully into practice, for instance, at the large refining works of the Consolidated Kansas City Smelting Company. Among the novel modifications of the process the most important is the melting of the crystals of pure sulphate of silver, which are separated in the course of the process with five per cent. of charcoal in the crucible. They are thereby, at a very low temperature, converted into metallic silver, which melts and is poured into bars. Carbonic and sulphurous gases are generated and escape without giving any inconvenience:

$$Ag_2\,SO_4 + C = Ag_2 + CO_2 + SO_2$$

Charles A. Keeler made a few remarks bearing on the question: "What constitutes a species?"

*April 18, 1892.* President Harkness in the chair.

Miss Alice Eastwood and William L. Watts were elected resident members.

The following communication was read:

SAN FRANCISCO, April 18, 1892.

*Secretary, California Academy of Sciences:*

DEAR SIR—The proprietors of Zoe have the honor to offer for acceptance of the Academy 50 copies each of volumes I and II of that journal, to be distributed to the principal societies of the world which are in correspondence with the Academy, in grateful acknowledgment of favors granted to the California Zoological Club and the California Botanical Club.

Respectfully,

H. W. HARKNESS,
T. S. BRANDEGEE,
KATHARINE BRANDEGEE.

The President then introduced Mr. Edward Muybridge, who delivered a lecture on "The Science of Animal Locomotion," with lantern illustration of consecutive phases of animal movements and syntethical reproductions by the zoopraxiscope.

CALIFORNIA BOTANICAL CLUB. *February 25, 1892.* The Vice-President, Mrs. M. W. Kincaid, in the chair.

Brofessor Douglas H. Campbell delivered a lecture on the Origin of Flowering Plants. The lecturer stated that the ancestràl forms of all the higher plants are to be sought among the fresh-water algæ. From these were probably developed forms like the simplest of the existing liverworts, and from these the higher forms, Bryophytes, Pteridophytes and Spermaphytes were later derived.

The structure of the simpler liverworts was briefly sketched and the development and fertilization of the archegonium and the subsequent development of the sporogonium described. Attention was called to the motile spermatozoids, and the necessity of water in fertilization, as indications of the aquatic nature of the ancestors of these forms.

Special attention was called to Riccia and Anthoceros as the most primitive in some respects of the liverworts, and the latter was especially spoken of as representing a form like that from which the higher plants have probably come.

The forms were next taken up, and after showing how the prothallium represents the liverwort thallus, and the fern itself the sporogonium, attention was called to the gradual reduction of the sexual prothallium and the increasing development of the sporophyte in the higher forms. It was then shown how this was accompanied by the development of heterospery in several groups, resulting finally in one case, at least, in the production of seed-bearing plants.

Flowers are only groups of special spore-producing leaves, with more or less accessory leaves in the more specialized ones. The simpler flowers are comparable to the spore-bearing leaves of an Osmunda, for example, or a spike of Equisetum. In the heterosperous Pteridophytes spores of two kinds were developed, and these in the flowering plants are the pollen-spores and the embryo-sac. The ovule and anther are simply special forms of sporangia.

In conclusion the influence of two groups of animals—viz., birds and insects—upon the further evolution of flowering plants were

spoken of. These have played an important part in the evolution of these forms as the development of edible fruits and brilliant flowers has undoubtedly been brought about mainly through their agency. As soon as the distribution of seeds and the pollination of flowers became dependent upon these, sharp competition was set up to attract these visitors, and the result we see in the amazing variety of forms now upon the earth.

*March 5, 1892.* Annual Meeting. The Vice-President, Mrs. M. W. Kincaid, in the chair.

The annual reports of the Secretary and Treasurer were read and ordered filed.

The following officers were elected for the ensuing year:

President—Douglas H. Campbell.

Vice-President—Mrs. S. W. Dennis.

Secretary—Frank H. Vaslit.

Treasurer—Miss A. M. Manning.

Librarian—Mrs. S. W. Burtchaell.

Curator—Miss Edith B. Falkenau.

Councilors—Mrs. L. D. Emerson, Miss C. H. Hittell, C. C. Riedy.

*March 24, 1892.* J. M. Hutchings in the chair.

The following were elected to membership: Volney Rattan, Miss Kate Hodgkinson, Dr. C. B. Brigham, James Denman, Miss Bertha E. Stringer, Miss Lotta Bean, Miss K. E. Cole, Mrs. L. H. Sharp, Miss Jessie Smith, Mrs. M. F. McRoberts, Theodor Michaelis, Dr. Joseph Pescia, Prof. W. M. Searby.

Mrs. Katharine Bandegee read a paper on the Fertilization of Flowering Plants.

The speaker gave a brief outline of the reproductive processes, as far as understood, of Phanerogamic and Cryptogamic plants, and showed that the latter approached much nearer the animal kingdom by their motile spermatozoids and necessity of fluid media. The fertilization of flowering plants is brought about by means of the winds, by the visits of insects and by the mechanism of the flowers themselves. The first two agencies, especially the second, had, the speaker thought, been unduly credited at the expense of the third. Diœcious and monœcious flowers were necessarily dependent upon the first two agencies, but in the great mass of annual plants, nearly all having hermaphrodite flowers, and so many of

them being in possession of a more or less elaborate mechanism whereby the pollen was brought in contact with the stigma of the same flower, it was logical to suppose that this mechanism was of some service. Attention was called particularly to the Onagraceæ, in many of which the flowers, even those with large and showy corollas were fully fertilized, while the bud was still firmly closed. Numerous instances were given of adaptations for self-fertilization.

Hybrids produced by the crossing of two distinct species rarely persisted in nature, and had not been enough studied. Closely related plants were often much more difficult to cross than more distant ones, the explanation is of course a purely mechanical one, to be sought for in the tissues of the respective plants. In one of the plants here shown, *Œnothera ovata*, which is invariably fertilized in the closed bud, the calyx-tube is from three to six inches in length, and the length of pollen-tube necessary to reach the ovules is an obvious factor in their fertilization. The consistency of the tissues of the stigma has also to be considered.

The term "cross-fertilization" has been very loosely applied in botany. Many use it indiscrimately to signify the crossing of the flowers in the same plant equally with the crossing of plants divergent for many generations. The first use is a misnomer for each plant if not an individual in the sense in which we ordinarily use in speaking of animals, is but a compound entity springing from a single germ.

In the fertilization of flowers by insects, the speaker said that observers preoccupied with the idea that "self-fertilization is injurious or destructive" had overlooked the importance of thrips, aphis and minute larvæ, which often cover the stigma with the pollen of the same flower.

The speaker was assisted by Mr. C. C. Riedy in showing under the microscope peculiar forms of pollen and the emission and entrance of pollen-tubes.

*April 26, 1892.* Miss Eastwood in the chair.

The following were elected to membership: Miss Kate Howell, E. P. Lynch, Mrs. E. W. Caswell, Miss Ottilie Schücking, Joseph Nordman, Miss Belle Ryan, Miss Edith Fassett, Miss Florence Lane, Miss Emily G. Britton, Mrs. Rowena C. Gray, Luther Burbank, J. Preuss, Mrs. A. B. Rice, Miss Agnes Regan, Miss Nettie Wade, Miss K. T. Callahan, A. L. Mann, B. L. Robinson.

Miss Alice Eastwood read a paper on Loco Weeds.

C. C. Riedy, assisted by W. E. Loy and L. M. King, gave a demonstration of the lower cryptogams under the microscope, ten instruments being used.

CALIFORNIA ZOOLOGICAL CLUB. *January 16, 1892.* The meeting was opened with a brief address by Dr. D. S. Jordon, following which a proposed constitution was read by the secretary pro tem. and adopted by the club. The following officers were then elected for the ensuing term:

President—Dr. David S. Jordan.

Vice-President—Walter E. Bryant.

Secretary—Charles A. Keeler.

Treasurer—Frank H. Vaslit.

Curator—F. O. Johnson.

Councilors—J. J. Rivers, W. E. Ritter, Dr. O. P. Jenkins, Miss Louise Bunnell.

*January 30, 1892.* President Jordan in the chair.

John Comstock, Professor of Entomology of Cornell and Stanford Universities, entertained the Club with a most instructive lecture on the subject of methods of scientific work, as illustrated in particular by a study of the methods of classification of insects. The speaker called attention to the great influence which the doctrine of evolution had had upon the methods of viewing scientific questions. Before the time of Darwin science had busied herself solely with the classification of species, but at the present time the great aim of scientific research is to trace the history of the changes and modifications in form and structure of parts—to study the function of organs.

If our knowledge of all the groups of organisms was complete it would be a comparatively simple matter to establish relationships, but the record is at best a fragmentary one, so our most satisfactory method is to trace each organ or part through all the stages of its evolution, and try to understand its use, rather than to attempt to follow the transformations of the species as a whole. Prof. Comstock then proceeded to illustrate this method of work by his investigations in the classification of butterflies and moths. He drew attention to the fact that in these insects the wings are covered with fine scales arranged in regular rows like tiled roofing. What can

this minute powder tell us of the history of butterflies and moths? An examination of various species discloses the fact that there is considerable diversity both in the structure and distribution of the scales. Among some species the scales are in the form of slightly flattened hairs, irregularly scattered over the surface of the wings. Between this type and the most specialized form of scale every gradation can be traced; and it is found, moreover, that in species in which the structure of the wings, antennæ and other parts discloses a lowly organization the irregularly disposed hairy form of scale is present. Furthermore, it is found that the specialization of the scale varies upon different parts of the wing.

In order to understand the use of these scales it is necessary to know something of the structure of the wing. The wing of the dragon-fly is cut up by a net work of intersecting veins, but in butterflies and moths the veins are fewer in number and cross-veining is rare. In the dragon-fly the mesh work of veins strengthens the wing, while in the butterflies and moths the scales perform this function. The more flat and regularly disposed the scales are, the greater will be their strength. Accordingly any variation in the direction of a flattened scale will be preserved by natural selection. It is to be expected, moreover, that the greatest change will occur in the region of greatest strain. It is found that this is indeed the case, for the scales are more flattened on the front than on the hind wing, and at the tip more than at the base. As an additional strengthener, ridges have been developed along the scale. Incidentally, these ridges have also been productive of a great variety of iridescent colors, by the interference of light. As soon as these color effects began to manifest themselves, sexual selection would be introduced as a factor in the modification of scales.

Having followed out one line of development it is necessary to correlate this with the evolution of other parts. The classification of insects is based largely upon the structure of the wings. In lower forms the wings are broad and far apart, while higher forms are distinguished by having them closer together and more compact. In order to give still greater strength to the stroke of the wings a bristle or clump of bristles known as a frenulum, is developed near the base of the upper edge of the secondary wing. When consisting of a bundle of bristles each one is a hollow tube, but when formed of but one bristle it is composed of a number of tubes joined to-

gether. It thus becomes apparent that the latter is a higher structure than the former, being composed of a bundle of bristles united into a single spine. Very frequently the female will have the frenulum in the form of a bundle when the male has but a single bristle. The reason of this is obvious, for the male is called upon to make greater use of its wings in flying in search of the female, and thus requires a more perfect structure.

Sometimes the base of the hind wing is extended up in the form of a shoulder binding the two wings together, and thus replacing the frenulum. In the silkworm moth there is a lobe at the base of the wing and a mere rudiment of a frenulum; even in the male this frenulum consists of a bundle of hairs, such as is present in the female of most species. It is an interesting fact that degeneration seems to directly retrace its steps of progress, as indicated by the above example. One moth, *Hepialis*, which is in some respects rather lowly organized, was found to have neither frenulum nor lobe. In place of these a sort of loop or thumb was found upon the front wing which Prof. Comstock has termed the jugum. This jugum occurs also in *Micropteryx*, in which genus an elaborate arrangement exists to receive it.

The speaker concluded from the above facts that the *Lepidoptera* had developed along two distinct lines distinguished by the style of organ used in binding the wings together, and he accordingly proposes the division of the order into two suborders, the *Jugatæ* and the *Frenatæ*. From all this it may be learned that a true system of classification must be based upon a study of the uses of parts.

*February 27, 1892.* Dr. Jordan in the chair.

After the reading of the minutes Dr. H. W. Harkness was called to the chair, while the president addressed the club on The History of the Zoological Explorations of the Pacific Coast.

The lecturer was chiefly confined to a historical review of the work which has been done on the fishes of the coast. The substance of the talk was as follows:

The first person associated with the study of the fishes of the coast was the German naturalist Steller, who was sent by the Russian Government in 1731 to study the animals of Alaska. Notable among his discoveries was the great arctic sea-cow *(Rytina stelleri)*, a skeleton of which is now owned by the Academy of Sciences.

He published an account of the salmon of Alaska, describing five species in all, under Russian names. These five species still stand, and nothing new has since been added to our knowledge of the salmon of the coast. He also studied the trout and his conclusions have proved in general correct. Indeed, there has not since that time been a stronger man on this coast, and every ichthyologist must do honor to the ability of a man who was able to follow out all the complicated species of salmon and trout, before the time of Linnæus.

Walbaum, a compiler of natural history, affixed scientific names to these salmon and trout in a work published in 1792, and his name is accordingly cited as authority for the species which Steller discovered and described.

Another naturalist in the employment of the Russian Government, named Pallas, printed in 1811 an account of his explorations in the same country that Steller had visited, but his work was apparently not very highly appreciated at the time, for it was not distributed until twenty years later. Pallas' trip across Siberia was notable for the discovery of the mastodon in the ice. His work was carefully done, consisting largely in authenticating by repetition the work of Steller, although he also discovered many new species in Alaska.

The above period may be considered as constituting the prehistoric epoch in the history of Pacific Coast explorations. In the second stage may be mentioned the work of Gairdner and Kittlitz. About the year 1830 Dr. Gairdner, a physician living in Astoria, collected many fish, especially salmon and trout, which he sent to Sir John Richardson to be described in his classic Fauna Boreali Americana. At about the same time an unknown German named Kittlitz recorded a single new species of fish.

In 1849 the modern history of California began, and with the host of emigrants that flocked to the Pacific Coast came a number of men interested in natural history. In the year 1852 a number of papers appeared on science, the most extensive and spirited writing being done by Dr. W. O. Ayres. His papers, as was customary at the time, were first presented to the California Academy of Sciences, appearing on the following morning in the Daily Placer Times. These papers have since been reprinted in the regular Proceedings of the Academy. Dr. Ayres described a considerable number of new species of fish from the coast in a very creditable

manner, but the severe criticisms of Dr. T. A. Gill eventually drove him out of the work.

Dr. W. P. Gibbons, of Alameda, about the year 1854, became interested in the most unique feature of the ichthyology of the Pacific—viviparous fish. Some twenty species of viviparous surf fish are known from the Pacific Coast of America, and with the exception of two others found in Japan, form a unique group. Dr. Gibbons described all the species he knew, but at about the same time Prof. Louis Agassiz received specimens which he also described. Much difficulty and confusion has thus resulted in regard to the priority of names, although in the majority of instances it has been determined that Agassiz had priority of date. Agassiz also published the first descriptions of many species of fish from Washington and Oregon, although he never visited the coast himself.

Dr. Charles Girard, who was connected with the Smithsonian Institution, also described a number of the viviparous fish, which served to increase still further the difficulty of establishing priority of names.

Allusion was next made to the work of Dr. J. G. Cooper, who was present at the meeting. Dr. Cooper began work in 1856, on the fishes collected on the Geological Survey, mostly from the southern part of the State, and much of the early investigations in that region were due to him. He described, among other things, the most vicious of the sting-rays from the harbor of San Diego, naming it after a young boy who had the honor of being the first person known to be stung by it.

The Pacific Railrord survey was finished early in the fifties, and the fishes were described by Dr. Charles Girard, a pupil of Agassiz. Despite his unusually good facilities in the way of specimens and books, he did no really good work. He described a vast majority of the fishes of the coast, but in a very wooden way which proved a great set-back to the study of ichthyology. Girard indeed did all a man could do to make it difficult to determine the trout.

Andrew Garet was at the Academy at about this time, but he did no work on the fish of this coast excepting the description of one new species from Mexico. He contributed some valuable additions to our knowledge of the fishes of the Sandwich Islands, however.

George Suckley, a surgeon in the War Department, was stationed in Washington and Oregon, and supplemented the work of Girard

on the fishes of that district. He succeeded in carrying the confusion to an extreme, making as many as three genera from a single species of salmon, founded on differences of age and sex.

Dr. Theo. N. Gill, who has been connected with the Smithsonian Institution for the past thirty years, has published descriptions of many fish that have been sent him, although he has never made any collections on the coast personally. Being the most learned student of fish in America, he has occupied a unique position as a critic, and is undoubtedly the best scientific critic the world has produced.

In 1865 Alexander Agassiz wrote a work on the viviparous fish of the coast, settling most of the disputes in regard to priority of names. This closes the period of the discovery of California fish. The presence of the viviparous surf-fish and the viviparous rock-cods, and the other general outlines of the coast fish, were by this time generally known, although but little attention had been paid to the species inhabiting the deep seas.

In the present period Prof. Cope has described a number of new species, mostly from Alaska. Dr. Steindachner, a brilliant German scientist, found a number of new species. He investigated the salmon question to some extent but gave it up as a hopeless task and published nothing on the subject. Most of the fish which he described were from Southern California and Mexico, his work being for the most part very accurate and his figures unparalleled for the fineness of their execution. In 1879, a versatile Englishman, an editor, engineer, poet and naturalist, was at work in the Academy. He described a number of new species and made a critical study of the flounders of the coast.

"In 1880," said the speaker, "it was my good fortune to be sent by the United States Fish Commission to make a survey of the fishes of the coast, abundant facilities of every sort being provided." Seventy-five new species were discovered and the salmon question was settled, practically as it had been left by Steller. Prof. Gilbert, who was his clerk and assistant, has since become very prominent as an ichthyologist. He has spent two years at work on the Albatross, making many important contributions to our knowledge of the deep sea fishes of the Pacific.

Dr. T. H. Bean visited Alaska in 1880, and reached the same conclusions regarding the trout of Alaska that the speaker had drawn from his studies of the California fish. Mr. E. W. Nelson

also made a good many observations upon fish while stationed in Alaska. In San Diego Miss Rosa Smith worked on fish, and has the honor of being the first woman to describe any new species. Dr. Eigenmann carried on work at San Diego and San Francisco, and accomplished considerable on the study of the fish of these places.

For the last three years the United States Fish Commission Steamer Albatross has been at work on deep sea soundings and dredgings, Mr. C. H. Townsend being the naturalist of the vessel during all this time. The results of these dredgings have been of great importance, about three hundred new species having been discovered, many of them very startling and impossible forms. The whole fauna of the abyssal deeps is very strange and peculiar. The fish are soft-bodied and have either very large eyes to enable them to catch the faint glimmerings of light which may reach them, or else are entirely blind. Many species are provided with curious phosphorescent lanterns to enable them the better to find their way about. Practically nothing was known of these remarkable fish before the work of the Albatross brought them to light. Occasionally one would be found washed ashore after a storm, or in the stomach of some larger shore fish, but by far the large proportion of them were totally unheard of.

*March 26, 1892.* Mr. J. J. Rivers in the chair.

Mr. Wm. E. Ritter delivered an address giving an historical account of the development of Tornaria, and of Balanoglossus from Tornaria. The affinities of Tornaria to the larva of Echinodermata and of Balanoglossus to Amphioxus were pointed out. One of the chief purposes of the paper was to call the attention of the members of the club to the possibility of finding Tornaria upon this coast, and the speaker described the indications of its presence. It is found upon silty beaches between tides buried in sand or mud, and may always be recognized by the peculiar pyramidal coil of the cast which is thrown out.

# ZOE

## A BIOLOGICAL JOURNAL.

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## CONNECTING FORMS AMONG POLYPOROID FUNGI.

BY LUCIEN MARCUS UNDERWOOD.

Read before the Indiana Academy of Science December, 1891.

As a prelude to this preliminary paper on the generic limits of the Polyporei, we wish to call attention to some of the anomalies in the pronunciation of the plural of *fungus*. The novice, innocent of classical erudition, usually essays it as *fŭngī;* the classically minded man brings it out as *foon-gee*, while a growing tendency, fathered at Harvard, fostered at Cornell, and by them distributed far and wide is *fŭngē*. This last is (1) a hybrid and (2), a monstrosity, and should be relegated to the department of teratology. Clearly two forms are allowable. If with our classical friends we believe that some novelty must be instilled into a dying tongue, then the melodious (?) *foongee* may be used. But since English is destined to take the place formerly held by Latin as the universal language of science, we deem it more logical as well as involving more common sense to say *fŭngī*.

The oldest genus of this family is Boletus established by Dillenius in 1719[1]. In this genus Linnæus included all the "Pore-fungi" known to him, passing over Polyporus established by Micheli in 1729[2]. Haller established Merulius in 1768[3], and Bulliard added Fistulina in 1781[4]. When Persoon gave his systematic survey of the fungi in 1801[5], three genera were recognized. Of these he established Dædalea and adopted Merulius (under which he placed Cantharellus, Adans. as a sub-genus), and Boletus (under which he

[1] Cat. Giss. 188.

[2] Nova Plantarum Genera, 129.

[3] Helv. em. 150.

[4] Champ. I, 314.

[5] Synopsis Methodica Fungorum.

included as sub-genera Fistulina, Polyporus and Poria). Fries in 1821[1] recognized five genera: Merulius, Dædalea, Polyporus, Boletus and Fistulina; in 1836[2] he added Trametes, Cyclomyces, Hexagonia, Favolus and Porothelium, and retains essentially the same arrangement in his Opus Maximus in 1874[3]. Berkley separated Strobilomyces from Boletus in 1860[4], and Kalchbrenner set apart Boletinus in 1873[5]; in this he has been followed by Peck,[6] who has made a special study of the American forms. Later writers have been more profuse in establishing genera. Peck[7] established Myriadaporus, which is based on an apparently monstrous growth; Karsten in 1881[8] from a study of the flora of Finland alone established eighteen new genera; Schrœter in 1888[9], while adopting only a few of Karsten's new genera, added three of his own from the flora of Silesia; Ellis and Everhart[10] have separated Mucronoporus based on the exceedingly slender character of pubescence of the interior of the pores! following a doubtful analogy to Hymenochæte, and last of all, M. C. Cooke has separated Sclerodepsis[11] from Trametes, a genus which already lacked any marked characters to separate it from Polyporus.

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[1] Syst. Mycol. I, 6.

[2] Genera Hymenomycetum.

[3] Hymenomycetes Europææ.

[4] Outlines of British Fungology, 236.

[5] Icones Selectæ Hymenomycetum Hungariæ, 52.

[6] Bulletin New York State Museum, No. 8 (1889).

[7] Bull. Torrey Bot. Club, xi, 27 (1884).

[8] Enumeratio Boletinorum et Polyporearum Fennicarum, systemate novo dispositarum, *Rev. Mycol.* 1881. The genera are Tylopilus, Cricunopus, Tubiporus, Rostkovites and Krombholtzia, among the Boletineæ; and Polypilus, Tyromyces, Polyporellus, Ganoderma (founded on *Polyporus lucidus*), Piptoporus (founded on *P. betulinus*), Fomitopsis, Bjerkandera (including *PP. adustus, hirsutus, versicolor, abietinus,* etc.), Antrodia, Hapalopilus, Pycnoporus, Caloporus, Ischnoderma, and Inonotus, among the Polyporeæ.

[9] Kryptogamen Flora von Schlesien, Pilze, i. The genera are Ochroparus, Phæoporus and Dædaleopsis, the last founded on *Dædalea confragosa*. Schrœter also separates *Merulius lacrymans* under Serpula Pers. (1801, as sub-genus), revives Suillus Mich. (1729), and further includes all of Lenzites among the Pylyporei.

[10] Jour. Mycology, v, 28 (1889).

[11] Grevillea, xix, 49 (1890).

To one who has made any considerable field study among the Polyporei their most striking peculiarity is extreme variability owing to habitat, state of growth, seasonable conditions and many other circumstances of environment. When *Polyporus hirsutus*, for instance, grows on the upper side of a log its pileus tends to produce a complete circle, thus reducing its attachment to a short central stem; when it grows on the side of a log its pileus has the normal semicircular form, but when it grows beneath the log it is reduced to a completely resupinate condition. And yet these forms represent three of the five subgeneric sections of Polyporus as usually recognized! It is easy to see how closet botanists poring over some herbarium fragments of pore-fungi, pour forth new species and genera by the score.

The connecting character of the family has long been noted. In 1836 Fries writes: "*Prorsus intermedii inter Agaricinos et Hydneos*[1]." Peck[2] has given an extended discussion of the intermediate character of the variable *Dædalea confragosa* showing its intimate relations to the three genera, Polyporus, Trametes and Lenzites. Two other common species of Dædalea possess also intermediate characters. *D. ambigua* is clearly in the form of its pores a species of Dædalia, but in its texture and other characters it is a species of Trametes with which indeed Fries had united it. *D. unicolor*, especially in its older stages, can scarcely be distinguished from an Irpex. Polyporus is also connected with Irpex through two variable and closely allied species, *P. abietinus* and *P. pergamenus*. Indeed these species are so closely related in some of their forms that their chief difference consists in one uniformly growing on the wood of Coniferæ and the other on the wood of deciduous trees! The lacerate pores of these species are often difficult to distinguish from the flattened teeth of Irpex.[3] Polyporus is further related to Lenzites through a polyporoid form of *Lenzites sepiaria* which, taken apart from its evident connections, would form an excellent species of Polyporus.

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[1] Epicrisis, 408.

[2] 30th Regents Report, 71.

[3] Peck (42d Regents Report, 38), has described var. *irpiciformis* of *P. abietinus* and calls attention to a second form of this species, which has been described as (*Irpex fuscoviolaceus*).

Through Strobilomyces, whose habit, combined with structural characters, is perhaps sufficient to keep it distinct, Polyporus passes to Boletus, and from Boletus there is a gradual connection through Boletinus, which stands on uncertain footing, to Paxillus, another genus of Agarics. Through Merulius with fold-like pores still another passage is made to the Agarics in the direction of Cantharellus. Sufficient has been said to verify the assertion of Fries, that the family is intermediate between the Agarics and the Hydnei.

A few conclusions may be drawn from the preliminary survey:

1. Among the Polyporei at least, Gœthe's statement that species are simply creations of the text-books, finds abundant illustration and warrant.

2. Generic and family limits are also exceedingly vague. Many of the genera are simply form-genera, and there is an amazing variety of connecting forms.

3. Several of the genera of Polyporei, as commonly accepted, have no rational basis on which to stand. From the genus Polyporus thirty genera could easily be formed with as valid reason as several that now exist. When characters are so poorly defined it seems a more rational proceeding to leave forms in few large genera than to establish new genera on characters that would ordinarily be regarded as merely specific. In regard to some of these genera we will specify changes:

(a) Trametes, with "trama descending between the pores," hangs on an exceedingly slender thread and had better be reunited with Polyporous. Though an error, it is perhaps significant that Saccardo describes *Polyporus cinnabarinus* under both Polyporus and Trametes[1].

(b) *Glœoporus*, with "gelatinous hymenium," has no more reason to be separated from Polyporous than *P. lucidus* has to be erected into a genus because it has a varnished skin[2]. It had best be returned to its original fold unless the South American forms reveal something more unlike Polyporus than has yet been discovered in the United States.

(c) Favolus, with "large angular pores," cannot stand as a genus if *Polyporus squamosus*, *P. lentus*, *P. arcularius*, and their allies,

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[1] Sylloge Fungorum, vi, 245, 353.

[2] Cf. Karsten *loc. cit.*

with pores just as large and just as angular, are to remain in Polyporus. We suspect that the same is true of Hexagonia, but we have seen too few species of that genus to form a definite conclusion.

(d) Mucronoporus, with spines within the pores, stands on about as valid ground as would a genus established on *Polyporus hydnoides* and characterized by the bristly hairs which thickly cover its pileus. Were the systematists among the flowering plants to divide every genus that possessed both glabrous and pubescent species, there would be even more hair-pulling in their ranks than has yet appeared.

(e) The subdivision of Polyporus on the basis of the color of the cortex and spores, as proposed by some continental botanists[1], is no more rational than to divide Viola into three genera to contain the blue, yellow and white flowered species respectively.

(f) No more rational is the sub-division of the same genus into Fomes, Polystictus and Poria. This seems to have been attempted by Fries[2] as a sort of experiment, but was not continued by him in his Opus Maximus,[3] nor other later writings. M. C. Cooke resurrected this classification in his Præcursores,[4] and he was almost immediately followed by Saccardo[5]. A few American mycologists, who do not seem to appreciate that Saccardo's Sylloge is a convenient compilation rather than a critical conspectus, have also adopted it bodily.

4. Dædalea will probably have to be united with Lenzites, but whether this united group will be agaric with polyporoid affinities, or polypore with agaricoid affinities, it would be hard to decide with the light thrown upon the genus by American species.

5. The genera about which there is no present suspicion are, so far as our flora is concerned, Polyporus, Boletus, Fistulina, Solenia, Merulius and perhaps Strobilomyces. Porothelium and Cyclomyces are not sufficiently known to us to permit a judgment.

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[1] Cf. Schrœter *loc. cit.*

[2] Novæ Symbolæ Mycologicæ, 1851.

[3] Hymenomycetes Europæ, 1874.

[4] Præcursores ad Monogragraphia Polyporovum, Grevillea, xiii, 80–87, 114–119; xiv, 17–21, 77–87, 109–115; xv, 19–27, 50–60 (1885–6).

[5] Sylloge Fungorum, vi.

## GEESE WHICH OCCUR IN CALIFORNIA.

BY L. BELDING.

The earlier writers credited this State with five forms of geese. These are now known to ornithologists as *Chen hyperborea*, *Anser albifrons gambeli*, *Branta canadensis occidentalis*, *B. canadensis hutchinsii*, and *B. nigricans*. In the fall of 1878 I sent a specimen of *Chen rossii*, which I got at Stockton, to the National Museum. It may have been collected here previously, but this was the first that I know of.

Number 76,654 of the U. S. National Museum, published in Partial List of Birds of Central California, under the name of *Chen albatus*, was probably a juvenile *C. hyperborea*, but I am not quite convinced that such is the fact. I think Mr. Ridgway ascertained that *albatus* is a synonym of *hyperborea*.

In 1885 Mr. Ridgway gave the smallest goose of the *canadensis* pattern of coloration the name of *Branta minima*, but afterward, during the same year, reduced it to subspecific rank, with the name of *B. canadensis minima*. A year or two later Mr. C. H. Townsend published the fact that Mr. Fiebig had collected *Philacte canagica* at Eureka, and during the past winter Mr. Ridgway identified parts of a goose I sent the National Museum from Stockton as belonging to a true *Chen cærulescens*.

Besides these, I believe the typical *Branta canadensis* occurs in California, but doubt if any specimen is in existence to prove the correctness of this opinion.

It may not be inappropriate in this connection to remind the ornithologists of California that we need a collection that contains a series of every American bird, and that without such a collection efforts to progress are unnecessarily difficult and will continue to be unsatisfactory.

LESSER SNOW GOOSE. *Chen hyperborea*. This is the very abundant white goose, which breeds in Alaska; reaches California about the first of October (Stockton Sept. 29, 1881; Gridley Sept. 30, 1884; Stockton Sep. 28, 1886), and leaves for its northern breeding grounds about the middle of April, a few remaining as late as the first of May.

At Stockton, in 1880, I saw the last flock April 30. They had been rare since the twentieth. They were last seen at Gridley April 28,

1884, and were last seen at Chico by Mr. Proud on April 27 of the same year. They sometimes enter California from the east slope in Nevada and leave in the same direction, probably stopping awhile about the numerous lakes of Nevada and northeastern California.

Mr. Evermann says it is an abundant winter resident of Ventura County. It was abundant in the northern part of San Diego County in the winters of 1884 and 1885, and Mr. Morgan told me he saw a great many of these and other geese at Ensenada, and on the head of the Gulf of California in the winter of 1883–84, which is probably about as far south as it goes on this coast.

Blue Goose. *Chen cærulescens.* Two of these geese were shot, one day, about February 1, of this year, by two hunters who were hunting together near Stockton. Mr. M. J. Shaw of the game market kept one of them on exhibition as long as he could, and then saved the head and neck, wings and legs. These fragments were all that I saw of the bird, and these I sent to Mr. Ridgway for identification. He said it was a true *Chen cærulescens*—a juvenile.

There was no white or light shade on the chin, nor on any part that I saw, and several persons who saw this goose before it was dismembered told me it was entirely blue except the quills. These were brownish-black. The blue was nearly that of the sand-hill crane. The wing measured about 15, tarsus 3, middle toe and claw very nearly 3, the naked culmen 2 inches.

I think the blue goose has not heretofore been reported in California, though my belief has been for nearly ten years that I have occasionally seen the plumage which is attributed to the adult, a few of which I shot, besides some I had seen in market, but the plumage of the uniform blue bird described above is new to me, as it was to many sportsmen and others who saw Mr. Shaw's specimen.

Ross's Snow Goose. *Chen rossii.* This diminutive white goose can readily be separated from any other form, being much smaller than any and having a warty appearance at the base of the bill. They weigh each about two and one-half pounds, have light colored flesh and are very palatable.

They breed in Arctic America, arrive in California with, or about the same time other white geese arrive, and probably go as far south

as they do, though I believe it has not been recorded south of Ventura County, where Mr. Evermann noted it as being frequent in winter.

My earliest notice of arrival is October 6, at Stockton, when I saw more than a dozen in market. It is a regular winter visitant to California and may nearly always be found in the Stockton market, as long as any of the wild geese are kept for sale. In the coldest weather few geese can be found in the interior of the State, north of Stockton.

Its notes are different from those of the other white geese. I kept a "winged" pair several months, which always resented undue familiarity. The male would always lead the female away from me and utter a strange grunting dissent if I got within a few feet of them. They had been captives a year already when I got them and must have had some sad experience, for I have known individuals of this species to be very tame. One day I found a nest in a pile of rubbish in the poultry yard, which had six eggs in it. The eggs were concealed with a covering of straw in regular goose fashion, and there were no other geese in the yard. I had several times seen the pair about this part of the yard and thought they might have a nest there, but the eggs I found were so much like hen's eggs in shape, and appearance of the shell, that I thought they might be hen's eggs. I never solved the problem, a young zealous egg-gathering lad having discovered and appropriated them. The pair finally escaped from neglect to keep their wings clipped.

AMERICAN WHITE-FRONTED GOOSE. *Anser albifrons gambeli.* This is known by hunters as the speckled-belly and yellow-legs. It breeds in the Arctic regions, and, according to Mr. Fannin, as far south as Vancouver Island. It is the first goose to arrive in California and the last to leave, staying a little longer than the white geese; is very abundant and fairly good for the table. It arrived at Stockton Sept. 7, 1878; Sept. 8, 1881. My latest spring record for it here is May 3. A great many passed Stockton the previous day on their way north.

Mr. Bryant found it as far south as Guadalupe Island in winter, and I heard of four near Cape St. Lucas, but the latter was exceptional.

Its early arrival in California is nearly every fall announced by the newspapers of the interior as an indication of an early winter.

In 1884, the Sacramento Record-Union of Sept. 2 noticed the arrival of geese, which were unquestionably of this species.

It is sometimes named the laughing goose, a name probably derived from its notes rather than from its gaping mouth.

CANADA GOOSE. *Branta canadensis.* Mr. Fannin says: "It is a very abundant resident of British Columbia, breeds throughout the interior of the mainland, appears in great flocks along the lower Frazer River during the winter months and affords fine sport for the hunters."

Dr. J. C. Merrill in the Auk of April, 1888, says (at Fort Klamath): "Of *occidentalis* I saw none, although they doubtless occur here. *Canadensis* seemed to be typical."

Like *Otocoris alpestris merrilli* and other birds, the Canada goose probably crosses the mountains and spends the winter in the Sacramento Valley, and perhaps in other parts of this State. In Yuba and Butte counties I have occasionally during many years noticed small, paler flocks of "Honkers," which reminded me of those I had seen and shot on the Illinois and Platte rivers.

HUTCHINS'S GOOSE. *Branta canadensis hutchinsii.* This for convenience on this occasion, we will call the medium-sized honker. It breeds in Alaska.

It is very abundant in the State in winter, arriving in the Sacramento Valley about the tenth of October. My earliest fall notice of it in Butte County is Oct. 9, 1884, at which time it was abundant. In the fall of 1891 I did not see or hear it until about Oct. 20, and my observations accorded with those of the market hunters on Butte Creek. It remains in the Sacramento Valley until about April 20, sometimes a few days later.

It goes about one hundred miles south of San Diego, according to Mr. Anthony, and is numerous in parts of San Diego County in winter.

Its notes are unlike the notes of *occidentalis*, and are also different from the notes of *minima*. I think it varies more in size than the latter, and that this variation is responsible for the difficulty experienced by some writers in separating them.

This goose was abundant during March, 1892, on Butte Creek, and about Gridley, but I did not hear or see *minima*. I have often seen them in separate flocks, but I oftener see these, like other geese, in large mixed flocks of various kinds.

WHITE-CHEEKED GOOSE. *Branta canadensis occidentalis.* This is the "Honker" of California hunters.

It is abundant in the State in winter, though not nearly as numerous as several other kinds of geese. It seldom arrives before the middle of November, sometimes considerably later, and not until comparatively cold weather sets in. It begins to leave usually about the middle of March, and I have seen a flock going east over the snow-covered Sierra Nevada as early as Feb. 22, 1887, during a mild sunny morning when I was hunting just below the snow line in Calaveras County, as I have often seen them going here and in Yuba County under similar conditions.

In Partial List of Birds of Central California, I am credited with the statement that this goose comes to this State and leaves it about same time that the American white-fronted goose does—one of the very few errors in that paper, which was otherwise very satisfactory to me. In that paper I mention that I have often seen this goose crossing the mountains (and leaving) about the middle of March, which partly corrects the error which must have occurred by an incorrect reading of my writing. I have not seen this goose as far south as San Diego County, but Mr. Morgan told me he had seen a flock of about a dozen at La Hoya, twelve miles north of San Diego, and had shot several of them.

I first saw it in market at Stockton Nov. 11, 1880, Nov. 23, 1881; at Gridley, Dec. 2, 1885.

It breeds sparingly in a large marsh at Tallac Point, Lake Tahoe, or did so recently; at Pyramid Lake and other lakes in the Great Basin, on the east slope of the Sierra, and is the only goose which is known to breed in any part of California. Its breeding habitat is much more southern than that of any other of the geese.

Mr. Fannin, in his Check List of Birds of British Columbia, refers to a single specimen taken in the interior of B. C., from which I conclude that he considers it rare in the province.

CACKLING GOOSE. *Branta canadensis minima.* This, the smallest goose of the honker color, is perhaps more abundant than any goose found in the State. On Butte Creek, a favorite resort for geese especially when they first arrive from the north, I am confident that I have seen a half a million of these geese in a single day. They arrive there from the first to the tenth of October; were already numerous Oct. 1, 1884. In the fall of 1891 it was in considerable force there, about two weeks before *hutchinsii* arrived.

My earliest Stockton date of its coming south is October 12; my latest spring record is April 25.

Mr. Morgan told me it arrived at Ensenada Oct. 12, 1884, and that he afterward saw it on the Blythe estate on the Gulf of California. I have seen it in San Diego County, and believe it goes as far south as Hutchins's goose.

The notes of *minima* are much higher in pitch than are those of *hutchinsii.* I noticed this the first time I ever saw them, in the year 1856, and upon asking my experienced hunting companion the name of a flock of *minima*, as it darted and tumbled in great disorder into the water, uttering the oft repeated notes which Mr. Nelson calls "luk-luk," he said it was the little squeaking goose, a name which I tried to give it in Partial List of Birds of Central California, but by an error the name was printed squawking goose. This goose is apparently generally known and distinguished from its larger cousins by the sportsmen of the State. Cackling goose is an appropriate name for it. I think it a good species. It breeds in Alaska.

BLACK BRANT. *Branta nigricans.* This is a coast species, and I doubt very much if it ever goes inland. It breeds on the arctic shores of Alaska, and scatters along the coast to about three hundred miles south of San Diego in winter.

I have not seen any of the species between San Francisco and the vicinity of San Diego, but a short distance north of San Francisco, at Bodega Bay, Mr. Palmer found it in abundance in March, 1885.

It leaves Alaska and comes south between the middle and last of September, according to Mr. Nelson, and remained at San Quintin Bay to May 9 or 10 in 1881, though it dissapeared from San Diego Bay April 15, 1884, and April 7, 1885, its departure having probably been hastened by the persecutions of the hunters.

It was until recently abundant in San Diego Bay in winter. Its flesh has an oily or fishy taste.

EMPEROR GOOSE. *Philacte canagica.* Collected at Humboldt Bay in the winter of 1884 by Mr. Fiebig. This is the only known occurrence of this northern species in California.

# NOTES ON THE TENEBRIONIDÆ OBSERVED IN SAN DIEGO COUNTY.

BY F. E. BLAISDELL.

*Edrotes ventricosus* Lec. A short, robust, and very convex species, found in the Colorado Valley, which includes the eastern or desert portion of the county. It is wingless and sparsely clothed with long hairs.

*Triorophus lævis* Lec. Occurs in the northwestern portion of the county. The species is apterous, and has the facies of an Otiorhynchide.

*Stibia ovipennis* Horn. Inhabits the seashore and is found beneath the beach-berry *(Mesembryanthemum æquilaterale)*, growing upon the sand dunes. This species differs from *maritima* in its larger and more robust form, smaller eyes, and larger, stronger elytral punctures.

*Stibia maritima* Casey. Inhabits the Coronado peninsula, not confined to the seashore. Moderately common, rarely blackish in color.

*Eurymetopon rufipes* Esch. Occurs in the central and eastern portions of the county.

*Eurymetopon convexicolle* Lec. Oblong-oval in form, and black in color. Very abundant beneath bark of trees and any object resting on the ground—as boards, rocks, etc. Feebly pruinose when first captured, although, the older the individual the less the liability to being so.

*Eurymetopon inflatum* Lec. A broad, elliptical species, ocurring in immense numbers in the sand dunes beneath the beach-berry and other maritime plants. Varies greatly in color, from black to pale ferruginous.

*Emmenastus longulus* Lec. An elongate-oval species, highly polished, varying in color from blackish to rufo-piceous, and generally strongly pruinose when observed in nature. Occurs abundantly beneath the bark of trees and shrubs, less numerous beneath boards and stones.

*Emmenastus piceus* Casey. An oblong, robust, parallel species, and dark in color. Have taken this species in the mountains about Julian, at an elevation of about 6,000 feet. A less typical form occurs at Poway (elevation 700 feet).

*Emmenastus obesus* Lec. A small robust species, piceous-black in color, and very pruinose while living. Very plentiful about San Diego, and generally found beneath dry cow manure, or boards, rags, etc.

*Epitragus pruinosus* Horn. Young individuals are quite pruinose, but on account of the polished surface of the integuments, it soon wears away. Not plentiful. Have taken it in my net from *Rhus laurina*, also beneath bark at the base of rotten trees.

*Zopherus induratus* Casey. Occurs in the mountains about Julian, where conifers and oaks are plentiful. The species is black, robust and convex, elytra somewhat shining. Length, 16.5 mm.; width, 7.0 mm.

*Phlœodes diabolicus* Lec. An oblong, indurate species, common in timbered districts. Have observed the larva and pupa in the rotton stumps of *Quercus agrifolia*. The adult insect feeds upon a large and tough species of fungus which grows upon the oak. Once I took thirty specimens from one large fungus growing on an oak stump.

*Noserus plicatus* Lec. Occurs beneath the bark of dead trees, in the mountains about Julian.

*Anepsius delicatulus* Lec. A small. elongate, apterous species. Rather common in maritime districts; have never taken it far from the coast, although it is said to occur in semi-desert regions. It varies in length from 3.5 mm. to 5.0 mm.

*Nyctoporis carinata* Lec. An elongate, rough insect. Elytra sculptured with several rows of sharp elevations. Occurs under the bark of trees. About San Diego it inhabits the shrubby hillsides, and can be found under the bark or leaves at the roots of the plants; also, in the sticks and debris that make up the nest of the wood-rat.

*Cryptoglossa verrucosa* Lec. An interesting form which occurs in the desert region of the county.

*Centrioptera asperata* Horn. Rare. Occurs at Poway and is nocturnal in its habits.

*Microschatia inæqualis* Lec. A robust, apterous species. Plentiful throughout the county. Occurs in spring, beneath boards, rocks, etc. Travels about during the day.

*Asida ægrota* Lec. Inhabits the desert region. Active at evening.

*Asida obsoleta* Lec. Occurs in the valleys of the central portions of the county. It is said to have been found at San Diego, but I have never observed it so near to the coast.

*Asida muricatula* Lec. Abundant at San Diego in August, beneath dry cow manure, boards, stones, and old tin cans. The domestic fowl have caused it to retreat to uninhabited districts.

*Asida angulata* Lec. Common throughout the county. A large black species, resembling *Eleodes* but quickly recognized by the angulate sides of the prothorax.

*Coniontis elliptica* Casey. Although this form is considered identical with *robusta*, I believe in its validity. The typical *robusta* occurs at Santa Barbara. A careful comparison of the two forms ought to convince the most skeptical as to their being specifically distinct.

*Coniontis subpubescens* Lec. Occasionally met with. Conspicuously pubescent. Length, 9.2–10.8 mm; width, 4.2–4.8 mm.

*Coniontis parviceps* Casey. Common about San Diego. Conspicuously pubescent. Length, 7.0–8.0 mm; width, 3.4–4.0 mm.

*Coelus globosus* Lec. Common in the sand dunes along the seashore. A species that varies greatly in form and size; probably some are valid species.

*Eusattus reticulatus* Say. There are undoubtedly two distinct species about San Diego. One form, which I consider the present species, has the broad prothorax of its immediate congeners; the other has a narrower prothorax with rather strongly convergent sides, relating it to *muricatus;* the epipleural characters agree with the present idea. The elytral sculpturing in the two forms is different; in the former the surface is raised into a net-work of ridges, while in the latter the surface is quite smooth, although there is a tendency to rugulosity. This form may be *difficilis*. Specimens have been identified for me by Dr. Horn, who pronounced them *reticulatus*; similar specimens were pronounced *difficilis* by Thos. Casey; in both instances they were the specimens with broad thoraces. Somebody is wrong—a problem for the future.

*Eleodes quadricollis* Esch. A form referred to this species is com-

mon throughout the county. Typical specimens in my collection were collected at San Francisco.

*Eleodes gentilis* Lec. Very abundant at San Diego.

*Eleodes interrupta* Blais. Related to the preceding species, but differing widely from it in elytral sculpturing. Rare. Occurs at San Diego.

*Eleodes femorata* Lec. Very rare. Occurs about San Diego Bay.

*Eleodes grandicollis* Mann. A large species, moderately common, throughout the county.

*Eleodes gigantea* Mann. A large elongate species, met with in all parts of the county that I have visited.

*Eleodes acuticauda* Lec. Common, especially in the interior.

*Eleodes laticollis* Lec. Moderately common at Poway.

*Eleodes parvicollis* Esch. Moderately evenly distributed.

*Eleodes parvicollis* var. *producta* Lec. Plentiful about San Diego. Inhabiting the shrubby hill-sides. They frequent the wood-rats' nests.

*Eleodes marginata* Esch. Moderately rare.

*Cerenopus concolor* Lec. Common in the eastern portion of the county.

*Cerenopus costulatus* Horn. Less common than the preceding species, and inhabiting the same region.

*Eulabis pubescens* Lec. Common everywhere. Frequents the vicinity of ants' nests.

*Eulabis laticornis* Casey. Rare. Occurs at Poway, beneath rocks near ants' nests.

*Eulabis rufipes* Esch. Common. A small species found beneath debris and bark of trees and shrubs. Evenly distributed.

*Eulabis obscura* Lec. A dark, depressed species, occurring plentifully along the seashore.

*Amphidora littoralis* Esch. Common in some localities in the interior. Frequents groves and is found beneath rocks, logs, and bark. The name is a misnomer, as I have never observed it along the seashore.

*Amphidora nigropilosa* Lec. Occurs along the seashore and in

regions immediately adjacent. Common on alkaline flats beneath any object upon the ground. Immature individuals while the integuments are yet soft, ascend small plants in the warm sun during the day, undoubtedly to hasten the hardening of the skeleton.

*Cratidus osculans* Lec. Common throughout the county. Frequents ledges and timbered districts. At Coronado they are plentiful in wood rats' nests, and about the roots of *Rhus integrifolia*. The species is clothed with moderately long hairs of a pale tawny yellow color.

*Cratidus fuscipilosa* Casey. Occurs on the summits of the mountains about Julian. Have found them very abundant in ledges and piles of loose rocks. Clothed with long, erect, piceous black hairs.

*Stenotrichus rufipes* Lec. Moderately common. Varies greatly in size; the male is frequently a mere pigmy, 5.0 mm. in length, while the female may be 8.0 mm. long. Found beneath bark, debris about bushes, etc.

*Cibdelis blaschkii* Mann. Inhabits the timbered and mountainous districts. Found beneath the bark of trees.

*Adelina lecontei* Horn. Not common. Sometimes met with in immense numbers under decaying and fungus-covered bark of dead sycamores. A depressed, reddish-ferruginous colored species.

*Ulus latus* Blais. Rare. Occurs along the San Diego River. Clothed with rather long, moderately slender, recumbent hairs. Elliptical in form and strongly convex.

*Ulus crassus* Lec. Common. Sometimes exceedingly abundant in March along the San Diego River. Oblong-oval in form, clothed with short, robust, dense hairs.

*Blapstinus longulus* Lec. Occurs under rocks on the mesas about San Diego. This species has an elongate, parallel, depressed form. The pubescence is short and sparse. The wings are moderately well developed, extending nearly to the apex of the elytra.

*Blapstinus dilatatus* Lec. Common, but not abundant. Rather evenly distributed. Prefers lowlands and timbered districts. Oblong in form, pubescence rather stout, subrecumbent, moderate in length. The wings are well developed; flight somewhat labored.

*Blapstinus rufipes* Casey. Common everywhere. Frequently pruinose Pubescence fine, rather long, very inconspicuous. Wings rather rudimentary, about two-thirds as long as the elytra.

*Blapstinus brevicollis* Lec. Plentiful in the valleys and lowlands near the coast. Oblong-oval and rather depressed in form. Pubescence fine and recumbent, inconspicuous. Wings well developed, longer than the elytra.

*Blabstinus coronadensis* Blais. Rather common at Coronado, moderately rare elsewhere. Elongate-oblong in form. Pubescence rather conspicuous, somewhat long, recumbent, and pale flavate in color. Wings well developed, about one-third longer than elytra.

*Blapstinus pubescens* Lec. Moderately common about San Diego Bay on the semi-alkaline flats. Pubescence very conspicuous, moderate in length, recumbent, and ashy in color. Wings well developed and longer than elytra.

*Blapstinus sulcatus* Lec. Common in the valleys and low lands about San Diego. Pubescence squamiform and robust, subrecumbent. Wings well developed.

*Conibius parallelus* Lec. Rather common about San Diego and Poway. A small, slender, convex insect, black in color and generally pruinose. Apterous.

*Conibius sulcatus* Lec. Common. Strongly convex and oblong-oval in form, black in color and generally pruinose. Occurs beneath stones and other material upon the ground.

*Tribolium ferrugineum* Fab. Rare, occasionally met with beneath bark of trees. A small, moderately depressed, ferruginous species.

*Gnathocerus cornutus* Fab. Common in ground cereals. Have observed it in all stages of development in "germea" of the stores; usually associated with *Silvanus surinamensis*. The species is elongate-oblong and depressed in form, ferruginous in color.

*Aphanotus brevicornus* Lec. Rather common in the eastern portion of the county. In this species the eyes are completely divided.

*Aphanotus parallelus* Casey. Not uncommon in the mountains about Julian Occurs beneath the bark of trees. Eyes not completely divided.

*Cynæus depressus* Horn. Common at Poway. Lives in the decaying roots of *Yucca whipplei.* Elongate-oval and very depressed in form.

*Phaleria rotundata* Lec. Exceedingly abundant on the sea-shore beneath kelp. Testaceous in color.

*Platydema oregonensis* Lec. Occurs in the mountains about Julian, on fungi which grow on old stumps and trees.

*Apocrypha anthicoides* Esch. Rare. Occasionally taken from beneath rocks or decaying melons; also, from beneath the bark of trees and shrubs. An elongate, wingless species resembling an anthicid.

*Apocrypha dyschirioides* Lec. Quite rare. Similar in habits to the preceding species.

*Helops bachei* Lec. Moderately rare. Occurs along the seashore beneath the beach-berry and Œnothera.

*Helops blaisdelli* Casey. Moderately common in some localities beneath maritime plants growing on the sand dunes along the seashore, near San Diego.

## A ROCKY MOUNTAIN BOTANICAL TRAMP.

BY F. D. KELSEY.

On June 27, 1892, a party of eight left Helena, Montana, for a botanical trip to the top of the main range, fifteen miles away. The party consisted of the writer and wife, H. M. and E. N. Brandegee, the wife and daughter of a prominent Helena capitalist, and two young ladies of botanical proclivities. The journey lay along a gulch for several miles where we found in bloom on this date *Ranunculus Cymbalaria, abortivus, sceleratus, affinis and Pennsylvanicus. Delphinium Menziesii* peeped out at us from beneath shrubs, always tempting a botanist to get out and gather each fresh specimen, though he knows he has more than he needs already. Coulter gives its range as "Wyoming, Montana and northwestward." Its deep blue color is charming and attractive and holds well in pressing. In this immediate region it is our only Delphinium.

Along the sides of the gulch now and then could be seen the humble but winsome *Berberis repens*, most of the plants which grow in great profusion being at this season out of bloom. Its yellow roots have considerable reputation for medicinal quality under the erroneous name of Oregon Grape.

*Corydalis aurea*, modestly hiding its curious blossoms under a bank or a profusion of leaves, nevertheless was eagerly seized by

many hands. Prof. Coulter reports var. *occidentalis* as the more usual one from this region, but Helena must be an exception for ours is the type.

Of mustards met with that day the following may be recorded: *Draba alpina* var. *glacialis*, *Draba nemorosa* var. *hebecarpa*, *Arabis perfoliata*, *spathulata*, *Drummondii* and *Holbœllii*, *Erysimum asperum* and *parviflorum*, *Sisymbrium canescens* and *linifolium*. This *linifolium* is a beautiful plant, glabrous, and every part of it made on the plan of straight lines. Coulter gives it as of very narrow range. It would grow as a luxuriant weed, but has never as yet been troublesome. *Sisymbrium canescens* may well be classed as one of our local, troublesome weeds, and in early spring is much infested by a fungus.

*Vesicaria alpina* was just going out of bloom, while in cultivated fields *Camelina sativa* is thriving at an alarming rate. It has been introduced through wheat and oat seeds.

*Capsella Bursa-pastoris* is cosmopolitan and is found all over our state, along roadsides, streets, fence corners and cultivated grounds. *Lepidium intermedium* is native, abundant and something of a weed.

Our most common violets are *Viola canina* varieties *sylvestris* and *adunca*. *V. cuculata* is said to be sparingly reported from the Rocky Mountain region, but it has been gathered at Helena, Deer Lodge, Bozeman, Anaconda, and the Belt Mountains, all in Montana. *V. Canadensis* is plentiful, and also *V. Nuttallii*. Since the date of this expedition the writer has gathered *Viola biflora* at Granite, Montana, at an elevation of eight thousand feet.

*Cerastium arvense* was abundant and *Stellaria longifolia* and *longipes* were plentiful, while *Arenaria congesta* var. *subcongesta* was just beginning to flower. *Lewisia rediviva*, locally called "Bitter root," was blooming profusely. It is a portulaca, with linear fleshy leaves lying flat on the ground in a perfect circle of 2½ to 3½ inches diameter. These leaves usually have disappeared by the time the bloom appears, so that the flowers seem to lift their rosy colored heads out of the bare, sandy plains. The bloom is wondrously cheery on a bright sunny morning. The roots are thick, covered with a deep red epidermis, and have a slightly bitter taste. When dried and pounded into a meal they make a very nutritious and acceptable diet, formerly much used by our Indians.

The hillsides in many places revealed the home of our wild flax,

*Linum Lewisii*, which gives promise some day of being of considerable commercial value.

*Negundo aceroides* grows luxuriantly all over this region and is a favorite tree for front yards in the city of Helena.

*Rhus aromatica* var. *trilobata* was found growing up little gullies, but had just gone out of bloom.

*Thermopsis rhombifolia* and *montana* were not found on this trip or region; but the writer knows that they were both in bloom at this time on regions but little remote from the range of the trip.

*Lupinus leucophyllus* surprised us by showing its blue racemes much earlier than was expected.

*Astragalus caryocarpus* was found both in bloom and in fruit, its large globular juicy pods giving promise of service as food for man: it is reported from some sections as used for pickles.

*Astragalus Canadensis* was only in bud; as also *A. adsurgens*, *hypoglottis*, and *Drummondii*.

*Astragalus Missouriensis* is very common on our plains, and always attracts the botanical eye both for its beauty of bloom and grace of pods. It clings close to the soil in its struggle for existence on our hot waterless plains.

*Astragalus Purshii* was abundant in fruit, but its bloom had gone. The bloom is very scant, yellow; but the pods are turgid and covered with glossy white long wool, giving them a very strange appearance as they lie flat upon the ground.

*Astragalus triphyllus* is also to be found on these gulch sides, but at this season out of bloom. One strange experience belongs to the writer, namely: while he has seen this plant by the thousands in bloom, he has never yet gathered it in fruit. Many a time has he bent down to search for its fruit, but thus far in vain.

*Astragalus inflexus* was seen, but not in bloom. *Astragalus bisulcatus* and *flexuosus* were just beginning to open.

*Oxytropis lagopus* was in full bloom, as also *O. Lamberti*, our dreaded "loco weed." Besides these the writer knows to be in bloom at this time in other regions of the State *Oxytropis nana*, and nearly ready to bloom *O. deflexa* and *splendens*.

*Hedysarum boreale* is also in bloom, but our specimens instead of being purple, as says Coulter's description, are invariably creamy white. Later, the writer finds this growing plentifully at an elevation of 8,300 feet.

*Prunus demissa* greeted our eyes frequently along the stream we were following.

*Purshia tridentata* was out of bloom until we came to the higher regions, and there we found the leafless bushes one mass of yellow, fragrant bloom; at places the mountain sides seemed golden as they were covered with this luxuriant plant. It is every way worthy of cultivation.

*Geum strictum* and *triflorum* were frequently found, the latter always attracting attention, both in bloom and fruit. The flowers appear like drooping buds, and the erect plumose fruits are lovely and graceful waving in the sunshine.

*Fragaria Virginica* var. *Illinoensis* was very abundant on mountain sides and parks.

Of the Potentillas we met *glandulosa*, *Norvegica*, *rivalis* var. *millegrana*, *Pennsylvanica*, *Hippiana*, *gracilis*, and *Auserina*. *Rosa Sayi* and *Arkansana* were in bud, with here and there a bloom.

One good sized tree of *Cratægus Douglasii* was met on the mountain side in gorgeous bloom; mixed with the surrounding pines and fir it seemed like a vase of Nature's own setting.

*Amelanchier alnifolia* was mostly out of bloom and in fruit.

As we climbed the mountain top we found *Geranium incisum*, and *Richardsoni*, *Acer glabrum*, *Trifolium eriocephalum*, *Rubus strigosus*, and *Astragalus campestris*.

In a bog on the mountain top we gathered fine specimens of *Saxifraga integrifolia*, and *Camassia esculenta*, whose fine bulb is delicious and nutritious, and ought to be experimented upon as giving promise of a new and valuable food product for our markets.

The delicate *Tellima parviflora* was eagerly gathered. *Heuchera cylindrica* and *parvifolia* we found everywhere on the mountain sides.

*Philadelphus Lewisii* was just making its appearance, and will soon become valuable for export all over the United States as a much prized shrub for lawns and gardens.

The Ribes met with were *R. oxycanthoides*, *lacustre*, *Hudsonianum*, *cereum*, *viscosissimum*, *floridum*, *sanguineum* var. *variegatum* and *aureum*. *Ribes viscosissimum* is a valuable low shrub, very fragrant. Its range is very restricted.

*Musenium trachyspermum*, *Sium cicutæfolium*, *Osmorrhiza nuda*, and *occidentalis*. *Zizia cordata*, *Pseudocymopterus bipinnatus*, *Peuce-*

*danum simplex*, and *Leptotænia multifida*, and a Peucedanum not yet identified, were our finds in Umbelliferæ.

*Cornus stolonifera* was in full bloom along the brooks.

*Sambucus melanocarpa* was in fine bloom upon the top of the range, and brought vividly to mind my honored friend Prof. E. L. Greene, who by this time I hope has forgiven me for tempting him one August to taste the rich fine black fruit. I took to my heels—he after me. I know of no animal that uses these fine appearing berries. Probably, also, Prof. Greene has discarded their use!

*Valeriana sylvatica* and *edulis* are just passing into fruit.

*Aplopappus acaulis* var. *glabratus* was just beginning to bloom, while *Townsendia Parryi* was in its prime and delighted every one whose good fortune it was to gather it. This plant is gorgeous and makes one of the finest of bouquet flowers as well as garden plants. The day is coming when horticulturists will "go wild" over it.

*Townsendia sericea* has wholly disappeared at this season.

*Erigeron macranthus*, *glabellus*, *compositus* var. *trifidus* met our gaze. *Antennaria dioica* was abundant, but *dimorpha* had disappeared. *A. Carpathica* was gathered, as also *Anaphalis margaritacea.*

*Balsamorrhiza sagittata* is exceedingly abundant in this region, but is out of bloom at this season except at high altitudes. *Chænactis Douglasii*, *Actinella acaulis*, *Gaillardia aristata*, *Achillea millefolium*, *Arnica cordifolia* and *alpina* rewarded our search, as also *Senecio canus* and *aureus*.

*Microseris troximoides*, *Crepis elegans*, *runcinata*, *acuminata* and *occidentalis* were in bloom, as also *Troximon glaucum.*

*Taraxacum officinale* var. *alpinum* grew sparingly on the top of the range.

*Campanula rotundifolia* was very abundant, as also *Arctostaphylos Uva-ursi.*

*Dodecatheon Meadia* in several varieties was found just going out of bloom. *Douglasia montana* was in fruit.

*Androsace septentrionalis* and *occidentalis* were sparingly found here, though near by they grow profusely. *Glaux maritima* is abundant on our damp plains. A few specimens were found of *Frasera speciosa*, which grows profusely in the mountains west of the main range.

*Phlox muscoides*, *canescens*, and *Richardsoni*, were all out of

bloom; *longifolia* was just getting beyond its prime. *Gilia spicata* was not found on this trip, although it was in bloom near by.

*Phacelia circinata*, *Franklinii*, *sericea* and *Menziesii* were all in bloom though not all found by our party on that excursion. *Echinospermum floribundum* and *Redowskii* were in bloom, while *Omphalodes Howardi* was in fruit. *Krynitskia glomerata* was in fine condition. *Mertensia oblongifolia* had passed into fruit, but *Sibirica* was in prime condition. *Lithospermum pilosum* and *angustifolium* had gone to fruit. *Collinsia parviflora* was past its prime. The Pentstemons in bloom were *acuminatus*, *cristatus*, *confertus* var. *cæruleo-purpureus*, and one as yet unidentified. *Synthyris rubra* had gone to seed. *Castilleia mineata* and *pallida* were sparingly found. *Plantago eriopoda* was plentiful on the plains. *Eriogonum umbellatum* was just coming into bloom, and *Shepherdia Canadensis* going out of bloom. *Betula occidentalis*, *Alnus viridis*, *Salix longifolia*, *flavescens*, *rostrata* and *Populus tremuloides* lined the brook sides.

*Cypripedium parviflorum*, *Iris Missouriensis*, *Sisyrinchium mucronatum*, *Camassia esculenta*, *Smilacina amplexicaulis* and *stellata*, *Fritillaria atropurpurea*, *Erythronium grandiflorum* var. *minor*, *Streptopus amplexifolius*, *Prosartes trachycarpa*, *Zygadenus elegans* were the liliaceous flowers in bloom. *Leucocrinum montanum* and *Fritillaria pudica* had long disappeared.

Of Conifers we met *Juniper communis*, *Pseudotsuga Douglasii*, *Pinus flexilis* var. *albicaulis*, *Pinus ponderosa* var. *scopulorum*, and *Pinus contorta* var. *Murrayana*.

## INSECTS FREQUENTING YUCCA BLOOMS.

BY C. H. TYLER TOWNSEND.

Any obsevations, however imperfect, relating to insects found frequenting the flowers of the various species of Yucca, are of much interest and value, in view of the attention which is being given to this subject by Dr. Riley, Prof. Trelease, and others.

It is believed by many persons now, since Dr. Riley first advanced the idea some years ago, that certain species of Pronuba, a genus of of small moths, are more or less indispensable to the fertilization of the Yucca flowers. Moreover, the benefit between the moth and the plant is believed to be mutual, inasmuch as the moth deposits

her eggs in the ovary of the flower and the larvæ bore in the green seed-pod. The moth has been observed to convey the pollen from the anthers to the pistil by a special act, as though impelled by reason or instinct, that the fruit might not fail to be fertilized and thus afford food for her larvæ. Whether, however, no other insects are able to fertilize these flowers is a mooted question. The Pronuba works in the evening only, and thus necessitates the employment of a dark lantern, a stepladder, and a great portion of the night spent on plains or mesas, in order to intelligently investigate its operations. As I have not been so situated that I could spend the proper time in the evenings on this work at the proper season, my observations have been made wholly in the day time. Therefore I have not observed the Pronuba moth at all, but have made, however, a few notes on the larvæ found in the pods as well as on other insects found in the flowers.

In the first place I should say that what is here recorded was observed in the vicinity of Las Cruces, New Mexico; and that our native Yuccas belong, as far as can be at present determined, to two species. We have *Yucca angustifolia;* while the other is a broad-leafed species at first supposed to be *Yucca baccata*, but which may prove to be *Y. macrocarpa*, in case the latter is a valid species. Mr. W. H. Evans, now of the Agricultural Department in Washington, gave me the above information and is now engaged looking up the matter.

COLEOPTERA.

*Carpophilus niger* Say, a small beetle belonging to the family Nitidulidæ, very plentifully infests the (flower) stalk buds of *Y. macrocarpa* (?) before the stalk has appeared, about the last of March or first of April. They eat holes in the outer covering and inside portions of the large flower stalk, which at first has the appearance of a bud in the center of the plant. They are also found later in the flowers.

*Epicauta cinctipennis* Chev. (?) Adult blister beetles, very much resembling this Mexican species, were found in the blooms of *Y. macrocarpa* (?) by Prof. Wooton, of the New Mexico Agricultural College, May 15, 1892. Several specimens were collected.

A ryhncophorous (?) larva was found, May 15, 1891, in the tip end of a pod of *Y. macrocarpa* (?) which had been picked May 10. It is a small white larva, apparently coleopterous, nearly 5 mm.

long, very chunky, and was taken from a little cavity in the extreme tip or distal end of the fruit.

### LEPIDOPTERA.

Pronuba (?) larvæ. What are undoubtedly larvæ of a species of Pronuba were found May 15, 1891, in pods of *Y. macrocarpa* (?). Four pods, picked May 10, showed two infested. A whitish lepidopterous larva was found eating through the white seeds, usually in the stem or proximal end of the fruit. Three were found in one pod, two being in the same tier of seeds. Out of 21 pods of this Yucca picked May 15, only five were found infested. Some pods contained several larvæ, in one case located near the tip or blossom end. Nine large larvæ, averaging over 10 mm. in length, and two small ones about 5 mm. long, were extracted from these pods (25 pods).

### DIPTERA.

A small black acalyptrate muscid, apparently belonging in or near the family Phycodromidæ, is very abundant on the flowers of *Yucca macrocarpa* (?) throughout its blooming period. In fact this fly is about the only insect to be found plentifully in the flowers through the day, so far as I have seen. Specimens were collected April 4, 1891. It is about 3 to 3.5 mm. long (body length), while the wings are 3.5 to 4 mm. long.

*Sarcophaga* spp. I have also noticed, in April and May, several species of Sarcophaga frequenting the flowers of this Yucca in the day time. They are often quite numerous on and about the flowers, but doubtless have nothing to do with the fertilization of the latter.

## BIRD NOTES FROM ALAMEDA COUNTY.

BY F. O. JOHNSON.

WESTERN ROBIN. *Merula migratoria propinqua.*—On the morning of Deccember 6, 1891, while pursuing a Townsend's sparrow which had flown to the top of a tall growth of jasmine, I noticed on the opposite side of the bush a strange bird moping in the shade. It observed me just as I saw it, and hopped sluggishly to another branch putting a bough between us. I thought I was acquainted with all the birds of this region, but this dusky stranger was altogether unknown to me. My first impression was that it might be

a catbird which had strayed from his rightful home. I crept up cautiously for I only had a small 22 calibre cane-gun, and easily approached within twenty feet. It made no note and did not pay the least attention to my maneuvers. When I killed it, I was still more puzzled, for it was totally different from anything I had ever seen. It appeared much like some European thrush.

The prevailing color is a dark hair brown varying to lighter or darker on different regions of the body. The top and sides of head, back, wings, tail and under-tail coverts are a uniform dark hair brown; throat somewhat streaked with ashy after the pattern of our robin, but the black streaks of the common bird are replaced by brown and the white by ashy; jugulum conspicuously washed by dark rusty, abruptly terminating at the belly with faint indications of a black band as in Hesperocichla; feathers of belly broadly edged with ashy; flanks washed with rusty, with short ashy streaks effected by the shafts which are of an ashy color, with often slight margins of the same on each side; bill of same, dark brown color; tarsi and feet also darker.

The bill is less notched than ordinarily in robins. This, together with the peculiar disposition of the rusty wash, at first made me rather chary in referring the bird to Merula, but on closer inspection it seems to be undoubtedly a rare melanistic plumage of our western robin. In taking on this singular phase, it has departed from the disposition of color seen in the ordinary bird as will be seen by the following: The top of head is no darker than the rest of the back; the black and white streaks of the throat of the ordinary bird are replaced by close irregular streakings of dark chocolate over an ashy ground; the rusty wash of the jugulum, instead of following clear down the belly to tail coverts, terminates abruptly at the breast. and gives way to an ashy cast which continues to the vent. The under-tail coverts, instead of being the lightest part of the bird's coloration, is as dark as elsewhere, and there is no trace of the white tips on the outer tail feathers. The downy under plumage is also darker than in the common bird.

These singular departures from the general tone of a robin are inexplicable to me, and at first made me doubtful in calling the bird a robin.

Although a few melanistic phases have been recorded of the eastern species, this is, I believe, the first specimen of a melanistic western robin recorded.

CALIFORNIA CREEPER. *Certhia familiaris occidentalis.*—On the 13th of November, 1892, I observed a California creeper in the tall cypress trees at Berkeley, in the grounds of the University. This is the first record of the creeper, I believe, for the county. The grounds are peculiarly adapted for this bird, there being large cypress, eucalyptus, pines and oak trees on the premises. On the following morning, while strolling through the same vicinity, a creeper was shot not over one hundred yards from where I had observed it the day before. It was probably the same bird, for close searching failed to find another and I have not seen once since.

RED-BELLIED NUTHATCH. *Sitta canadensis.*—This nuthatch has generally been regarded as an uncommon visitant of the vicinity of Berkeley and Oakland, yet in November I observed them five or six different times and in the winter months I could find a pair almost any day about the pines of the University. They were nearly always associated in pairs and frequently would maintain for many minutes that monotonous call so peculiar to the nuthatches. The last I heard them was near the first of May.

BLACK-THROATED GRAY WARBLER. *Dendroica nigrescens.*—One bird was seen by me hopping in a cypress tree at Berkeley, abut the 1st of November. I know of no previous record for the county. Though a passing migrant, it appeared perfectly at ease, and in no hurry to leave the spot.

TOWNSEND'S WARBLER. *Dendroica townsendi.*—During last fall I saw four of these rare birds, two of which I secured. On the 24th of November, I secured a male in full plumage. He was lively and uttered a short call-note from time to time. I only wounded him the first time I shot and he made some short quick chirps and another bird flew to the top of the tree and responded. It was probably a female, but as it kept out of range of my little pistol I was unable to secure it. When I shot the male the second time it flew away, and I could not find it again. Out of six I have seen taken in California, this is the only one that is in full adult plumage.

## ZONOTRICHIA ALBICOLIS IN CALIFORNIA.

April 22, 1892, I shot a fine male near Stockton, which makes, I believe, the third specimen taken in California. L. BELDING.

# NOTES ON SCIURUS FOSSOR Peale.

BY F. STEPHENS.

In southern California the California gray squirrel is found only in the pine region, and principally in the lower part of that region where oaks are interspersed among the pines. My acquaintance with the species in life is confined to San Bernardino and San Diego counties, where I have seen it as low as 4,500 feet altitude and as high as 8,500.

In southern California this squirrel does not hibernate, though probably not coming out of its nest in very stormy weather. It does not appear to store up much food for use in stormy weather, but depends mainly on foraging even in winter. Their homes appear to be hollows in trees all the year through. These are lined with leaves, strips of bark, etc. The nests composed of twigs with the leaves on them, seen in the tree tops, are used for bringing forth and rearing the young, though perhaps used by adults in the heated term. June 23, 1885, I obtained a female and four young from such a nest. The nest was in the summit of a large mountain alder, growing along a stream on the south side of Grayback, the highest peak of the San Bernardino Mountains, at about 8,000 feet altitude. The surrounding forest was principally large yellow pines and evergreen oaks. These young were yet blind and their pelage was so short as to scarcely hide the skin.

The breeding season is rather long. In my notes I find records relating to the breeding of this species as follows: March 25, four females shot, one with three embryos, one with two, one with one and one with none; May 28, a female taken which appeared to have reared young recently; June 23, female and four young taken as mentioned above; July 3, one female taken was suckling young and another contained two small embryos; July 5, female taken contained one half-grown embryo.

As far as these records go they show the number of young to be one to four, with two and three as the usual number. They may be taken as indicating the rearing of young twice a year, but I feel in doubt of this being the case. As I have taken ungrown specimens in spring I think it takes a year at least for individuals to grow to maturity. As the species does no harm to crops and is fair eating it should be protected, at least during the breeding season.

This squirrel varies in abundance in the same locality in succeeding years without apparent cause. Some hunters think it is subject to epidemics, which is probable. Last March I picked up one dead that on skinning showed no wound. It was much congested, so that the veins all over the body were very distinct. It was in fair condition for the season, so its disease was not of long standing

The seasonable variation of this species consists of the addition in winter of an ochraceous or cinnamon-rufous wash over the upper surface, principally over the shoulders, but often extending from the neck to the rump. In some winter specimens this wash is quite strong, but in others it is hardly appreciable. This difference in color is only in the next to the last annulation of the hairs of the upper surface. These annulations in summer are nearly pure white but in winter they become more or less rufous colored. The last, blackish annulation or tip, being short, does not much obscure the color of the lighter band below.

A comparison of specimens from San Bernardino and San Diego counties with specimens from near San Francisco in the collection of the Academy of Sciences shows the southern squirrel to be intermediate between the two forms found near San Francisco. I hardly know whether to refer the southern animal to *Sciurus fossor* or to Mr. Bryant's new sub-species *nigripes*. It may even need separation sub-specifically from both, as it is certainly a little different in color from either. The southern animal is quite constant in color except the presence of the ochraceous wash on the dorsal surface of some in winter.

I have not been able to consult Audubon and Bachman's original description of *Sciurus leporinus*, which has been discredited by most later authors, but from Baird's reference to it I am inclined to think that it was founded on a northern California individual having an unsually strong wash of ochraceous or chestnut on the upper surface, about the color that I should expect to see on winter specimens from, say, Humboldt. It is probable that *leporinus* will ultimately be restored and *fossor* of Peale be placed in the list of synonyms.

# SOME OF THE METHODS AND IMPLEMENTS BY WHICH THE PACIFIC COAST INDIANS OBTAINED GAME.

BY L. BELDING.

The bow and arrow was here, as in most parts of the globe, a standard weapon of the natives. The spear was also an important implement of destruction, judging by the numerous carefully made spearheads which are so widely distributed in and on the soil.

Perhaps next to these in importance, in California at least, were the sling, or throwing stones. This is mere conjecture, for, while the grooved and perforated stones of this State are well known to ethnologists, but little is known concerning them. As they are so often turned up by the plow, they were probably in use at no distant day. The Mexicans who first came to California must have had good opportunity to learn the use of these stones—much better than the Americans who came later. They were probably extensively used in killing ducks and geese. Some partially flattened, bevelled, and pointed, grooved stones, which are found in Butte County, appear to indicate that two or more were tied to a common center and thrown together just as they were thrown in Alaska, as described by Mr. Turner. Other forms were probably thrown singly. In the large tule marshes where water fowl must have been swarming, as is still the case a portion of the year, and in other stoneless tracts, the hunter must recover the stone or his occupation would soon be gone. It would be almost impossible to recover it if it fell in the dense tule thickets or ponds unless a string was attached to it. It may have been a long string, one end of which was held in the hand. A short string might answer the purpose if some prominent object was fastened to it—a white quill for example.

Geese and ducks were, no doubt, much tamer before guns were introduced here, but even now, on Butte Creek, when millions of geese first arrive in the fall, a thrower of average skill could kill geese in the manner I have suggested.

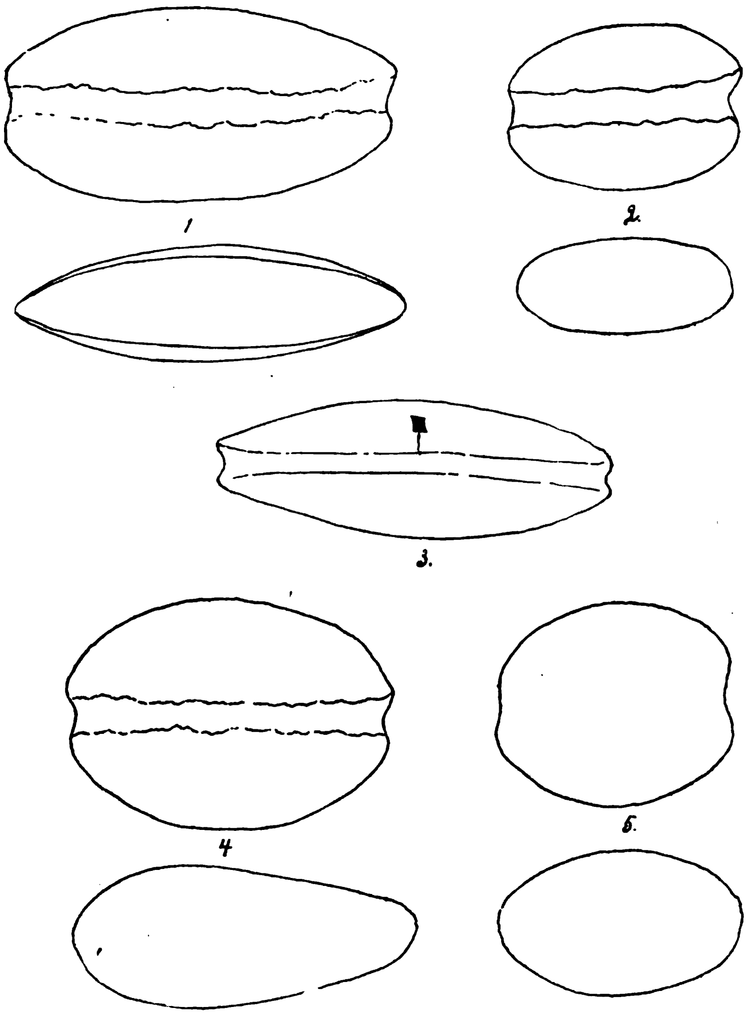
The accompanying figures represent the throwing stones above referred to:

Figure 1. Length 90 mm.; breadth 45 mm.; thickness 25 mm.

Figure 2. Length 52 mm.; breadth 42 mm.; thickness 28 mm.

Figure 3. Length 95 mm.; diameter 32 mm. This may have been used a pendent or charm.

Figure 4. Length 77 mm.; breadth 51 mm.; thickness 30 mm.
Figure 5. Length 55 mm.; breadth 49 mm.; thickness 40 mm.




Dr. Heermann, who was in California soon after the discovery of gold, says Lieutenant Stoneman, of the United States Army, told him that he had seen "Californians" catch geese in a lasso, as they flew low against a strong wind, and that he, Heermann, had known

a "native" to procure seventeen geese in a single charge, on horseback, through a flock of several acres, by riding near the flock and suddenly putting spurs to his horse and striking the geese with a club. The wielders of the lasso and club were probably Mexicans, but the manner of killing the geese deserves mention here.

Lieutenant Birnie, in Geographical Surveys west of the One Hundredth Meridian, describes peculiar blinds that the Indians near Death Valley made, just by springs and artificial ponds, for the purpose of killing quail and other birds. The blinds had the general appearance of beehives; were made of rushes and small boughs interlaced, with an opening for entrance on the side away from the spring. The inside was large enough to seat one person. There was a small hole on the side toward the water through which the arrow was shot. A string was attached to the arrow, and repeated shots could be made with it without alarming the game.

The Indians of Calaveras County catch mountain quail (Oreortyx) with snares of hair and twine. They make brush fences, about two feet high and from a fourth to half a mile long, leading obliquely from a creek or cañon, over a hill that is covered with a dwarfed growth of chaparral. Holes large enough for a quail to pass through are left in the fence, and in these holes the snare is placed. The birds are driven toward and along the fence, care being taken not to press them too hard. The birds are taken from the snares a little later and are usually uninjured by the snare, the loop of which is intended to catch the quail around the body in front of the wings.

I suppose these Indians sometimes caught deer in snares, having once, while following a deer-path through a thicket of small pines, found a rope-snare fastened to the top of a bent sapling and so set as to endanger any deer that might pass along the path.

The Pit River Indians caught game by digging pits about six feet deep and covering them with twigs and grass. This custom gave the name to the river and tribe.

Mr. Ridgway, in Ornithology of the Fortieth Parallel, says the Indians of the Great Basin [in Nevada] made elaborate decoys of canvas-back and red-head ducks, the skins stretched over bodies of dried tules, the heads prepared and poised in a style equal to that of the most accomplished taxidermist. The floating decoy was fastened by a stone tied to a string, the other end of which was fastened to the bill.

California Indians, according to Dr. Heermann, entrapped mallards and other ducks in a weir made of willow branches, and also shot ducks with arrows from ambushes built on the shore.

Dr. Suckley, in Natural History of Washington Territory, about the year 1860, says the Indians living along the Straits of Fuca destroyed vast numbers of wild ducks by shooting with shot, and when short of ammunition with arrows; that they obtained ducks in great quantities by stretching long nets on a line suspended on poles which were about as far apart, and looked much like telegraph poles. The poles were erected on the long sand spits running out from points and dividing bays along the straits. The nets were stretched at nightfall, directly in the course of the flight of the birds as they flew from bay to bay, and from point to point. He adds that the Lummi and Skadgett Indians obtained ducks at night by fire—hunting with canoes and lights. The ducks dazzled and bewitched by the light would allow it to approach so near that they were killed with arrows and spears. It was not unusual to take a good sized canoe load in this manner in a single night.

Lucien M. Turner, in Arctic Series of Publications of the United States Signal Service, says before the natives of Alaska had guns they usually caught geese in nets, which were about three feet high and thirty feet long, on the margin of a pond. When the geese were near enough the net was thrown over them by a man who was secreted near the net. Another method was to use three rounded stones of nearly equal weight and size, generally about one and one-half inches in diameter, though they differed with each individual's strength, the women also using lighter stones than those used by the men. A groove was cut around each stone and deepened sufficiently to hold a strong thong of seal skin about twelve inches long. The three loose ends of the strings were tied together, placed in the palm of the hand, and the stones that were attached to the other ends of the strings were carefully disposed on the coiled thongs in the hand. A flock of geese that came near enough would have this "bolas" thrown at them and it was "certain to become entangled on the neck or wings of some goose which fell to the earth and was immediately secured. The women were adepts at throwing these stones. An old woman told me that she had often got two, and, occasionally, three geese at a single throw."

E. W. Nelson, in the same series, says "the wolf is trapped by

the Eskimo in a peculiar manner, which is also practised by the Eskimo north of Hudson's Bay. A piece of whalebone about eight inches long, and of the size of a flattened lead pencil sharpened at both ends, is soaked in water until it is thoroughly softened. It is then bent on itself in folds about an inch long, and is tied in this position until it is thoroughly dry. The cord is then removed and the coil retains its position. It is then covered about an inch thick with tallow and laid out for the wolf to find. The latter picks up the morsel of fat containing the whalebone, and not being able to chew it, gulps it down entire. In a short time the juices and warmth of the animal's stomach act upon the whalebone and it slowly straightens out and the sharp points transfix the stomach, and if they do not enter the heart and lungs and produce death at once they cause the animal such agony that he lies down and becomes an easy prey for the hunter who follows his trail."

There is an Alaskan bird sling in the Academy collection which is quite similar to a form described by Wood, Knight, and others. It consists of ten small pieces of ivory, each of which is pierced and fastened by a string about thirty inches long. On the other end of each string is a slender quill five or six inches long, and all of the quills are bound together with sennet.

The above, though it does not exhaust the subject, proves that the Indians of this coast were very ingenious in capturing birds and animals, and some of them were equally ingenious in catching fish. The Washoe Indians are very successful is spearing trout when the fish run up stream to spawn. They build huts of boughs over brooks, the fisherman being able to see the fish just below him from the dark interior of the hut, while the fish cannot see the fisherman. About forty years ago, when the writer was in Bering Straits and the Arctic Ocean, the favorite recently adopted harpoon of American whalemen—the so called toggle iron—was modelled after an Eskimo bone harpoon used by the natives about the Straits.

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The white water lily mentioned in the Botany of California as occurring about the head-waters of Eel River has been definitely located by Mrs. E. C. Campbell, who obtained roots from a Mr. Crabtree, living a few miles from Bartlett Springs. No flowering specimens have yet been seen by botanists.

# MARIPOSA COUNTY AS A BOTANICAL DISTRICT.

## III.

BY J. W. CONGDON.

Before proceeding to discuss the plants of the coniferous belt, I take this opportunity to make some corrections in my former lists.

Since they were prepared, it has been my good fortune to visit San Francisco and enjoy the opportunity there to study, as well as I could in the brief time which other engagements permitted, the large collections of the Academy of Sciences, principally, with reference to the correction of errors in my determinations of our many difficult species.

In making this examination I was indebted to Mrs. Katherine Brandegee, curator of the herbarium, for valuable suggestions and assistance, which it gives me great pleasure to acknowledge.

These corrections, as will be seen, consist partly in correcting mistakes in identifying the plants themselves, and partly in making the nomenclature adopted conform to the latest and best authorities. This applies principally to the Umbelliferæ. *Podosciadium Californicum* Gray of Bot. Cal. is *Eulophus Californicus* C. & R. of Coulter and Rose's Revision of the Umbelliferæ. *Ferula dissoluta* Wats. is *Leptotænia dissecta* Nutt. *Deweya Hartwegi* Gray is *Velæa Hartwegi* C. & R. *Stephanomeria paniculata* Nutt. should be *S. virgata* Nutt.

The plant referred to as *Phacelia phyllomanica* Gray is *P. platyloba* Gray, and is also clearly the plant described by Mr. Greene under the name of *P. Arthuri*. Mr. Greene's character is taken from a single plant, evidently a waif from the foothill region, where the species is not rare.

*Mimulus nanus* Hook. & Arn. of the list is clearly a mixture of two and probably three species. The Mariposa plant is *Mimulus subsecundus* Gray, mingled with an apparently undescribed species of the same general habit.

In the coniferous belt, the place of these species is taken by another which, judging from careful observations made since my return, is probably the original *Mimulus nanus* of Gray, but whether Gray's plant or the present agrees with the *nanus* of Hooker and Arnott I have no means of determining.

*Mimulus Pulsiferæ* Gray of the list is *M. floribundus* Dougl., and the plant so designated in the list is yet undetermined.

*Fritillaria atropurpurea* Nutt. should be *F. parviflora* Torr.

## THE CONIFEROUS BELT.

As we go eastward from Mariposa we gradually ascend, and at a distance of about ten miles we meet the western or lower edge of this zone. The line of demarkation here is quite plain and is indicated by the commencement of the continuous pine forest, and also by the appearance of the so-called bear clover *(Chamæbatia foliolosa)*. This plant begins with the pine forest at about 3,000 feet, and forms a nearly continuous elastic mat about a foot deep under the trees, extending nearly or quite to the upper line of this zone, at about 6,000 feet. This upper boundary is not as clearly marked as the lower one, but is here understood to coincide with the line which bounds the territory inhabitable throughout the year. Above 6,000 feet the country, though beautiful and furnishing the most delightful and healthful summer residence in California, is usually covered in the winter with snow to a depth which practically makes a winter residence impossible, and hence excludes any permanent population. The subalpine zone, as here indicated, consists principally of certain high plateaux hereinafter described lying between the principal mountain ridges and of the great intervening valleys formed by the rivers, while all that portion of the heavily wooded zone which lies below is included in the Coniferous belt.

The forest, which, originally at least, covered substantially the whole of this belt and still covers by far the greater portion of it, consists principally of yellow pine *(Pinus ponderosa)*, but the cedar *(Libocedrus decurrens)* is everywhere common, without occupying any tract exclusively. At about 4,000 feet, the white spruce *(Abies concolor)* and the Douglas spruce *(Pseudotsuga Douglasii)* begin to be frequent along the streams, while the sugar pine *(Pinus Lambertiana)* becomes abundant on the upper slopes.

The magnificent size and the perfection of growth which all these trees here attain are not surpassed in California. Oregon, even, can hardly show more noble specimens or more valuable tracts of timber.

The deciduous trees in this zone are not usually conspicuous either for number or size, but the golden cup oak *(Quercus chryso-*

*lepis)* is often a marked exception. Single trees of this species are often found which, in size of trunk, in wide expanse and symmetry of growth, vie with the noblest oaks of the coast, while, in the beauty of the foliage and of their golden-velvety fruit, they surpass all our other species. The golden cup of the coast, indeed, is commonly but a scraggly, ungainly tree compared with the same species in our coniferous belt. The black oak *(Quercus Kelloggii)* is frequent in the woods, while along the streams the flowering dogwood *(Cornus Nuttallii)*, the alder *(Alnus rhombifolia)* and a few willows represent nearly the whole of our deciduous trees in this belt.

In the following list of species, in addition to the letters and marks previously used, Ct. indicates that the plant is also found on the coast, while Y shows that the plant is a portion of the peculiar flora of the Yosemite Valley:

Ranunculus hystriculus Gray. Wet cliffs, Merced River, Devil's Gulch, etc. Y.

Actæa spicata L. var. arguta Torr. Scarce. Ct.

Dicentra formosa DC. Rocky beds of streams. S. Ct.

Dentaria tenella Pursh. Frequent.

Streptanthus tortuosus Kell. Rocky hills. S.

Viola lobata Benth. Frequent above 4,500 feet. S.

Silene Lemmoni Wats. Occasional above 4,500 feet. S.

incompta Gray. Common. S.

Bridgesii Rohrbach. Mostly above 5,000 feet. Perhaps identical with the last. S. Y.

Sagina Linnæi Presl. Banks of streams. Occasional above 4,500 feet. S. A.

Claytonia linearis Dougl. Darrah. Local.

Limnanthes Douglasii R. Br. Wet rocks. C. S.

Ceanothus integerrimus. H. & A. Frequent.

decumbens Wats. Frequent above 4,500 feet. S.

Staphylea Bolanderi Gray. Snow Creek, Devil's Gulch, etc.

Lupinus albicaulis Dougl. vars. Various peculiar forms credited to this polymorphus species are abundant and also subalpine.

Lupinus Grayi Wats. A beautiful species frequent below 4,500 feet.

Trifolium Breweri Wats. Occasional in the woods, forming mats, more abundant above. S.

Hosackia crassifolia Benth. Occasional on clayey slopes. S.
decumbens Benth, var. (?) Nevadensis Wats. Occasional in open clayey soils. More common above. S.
Lathyrus paluster L. var. myrtifolius Gray. Frequent on hillsides below 4,500 feet.
Nevadensis Wats. Frequent below 5,000 feet.
Prunus emarginata Walp. Scarce below 4,500 feet, frequent above. S. Ct.
Rubus leucodermis Dougl. Frequent below 4,500 feet. Ct.
Saxifraga peltata Torr. Rocky beds of streams, Devil's Gulch, &c. Frequent above. S.
Ribes sanguineum Pursh. Stream banks. S. Y. Ct.
Menziesii Pursh var. subvestitum. Perhaps new species. Footman Mt. and south in the Sierras above 4,000 feet.
Sedum obtusatum Gray. Rocks. Frequent. S.
radiatum Wats. Rocky hillsides above 4,000 feet. S. Y.
Cotyledon Nevadensis Torr. Cliffs, Devil's Gulch, Hite's Cove. S.
Gayophytum ramosissimum T. & G. Moist grounds. S.
diffusum T. & G. Dry slopes. S.
Clarkia rhomboidea Dougl. Frequent in woods below 4,500 feet.
Circæa Pacifica A. & M. Wet places below 4,500.
Selinum capitellatum Benth & Hook. Banks of streams. S.
Cornus Nuttallii Audubon. Frequent above 4,000 feet. S. Ct.
pubescens Nutt. Stream banks, mostly above 4,000 feet. S.
Symphoricarpus mollis Nutt. Frequent above 4,000 feet. S.
Galium trifidum L. Scarce in wet grounds. S. Ct.
asperrimum Gray var. ? asperulum Wats. Wet thickets. Frequent. S.
Bigelovia graveolens Gray. Occasional, especially above. S.
Sericocarpus rigidus Lindl. Banks of streams below 5,000 feet.
Aster radulinus Gray. Occasional below 4,500 feet. Ct.
Erigeron Breweri Gray. Rocky places above 4,000 feet. S.
Adenocaulon bicolor Hook. Deep shade below 5,000 feet. Ct.
Antennaria luzuloides T & G. Dry slopes above 4,000 feet. S.
Balsamorhiza Hookeri Nutt. Darrah. Local. Ct.
deltoidea Nutt. Frequent below 4,500 feet.
Wyethia ovata Gray. Open grounds, frequent below 4,000 feet.
Cnicus Andersonii Gray. Frequent. S.
Microseris nutans Gray. Frequent above 4,000 feet. S.

Malacothrix obtusa Benth. Occasional among rocks in clayey soils (also at Benton Mills).
Campanula prenanthoides Durand. Dry slopes, frequent above 4,000 feet. S. Ct.
Rhododendron occidentale Gray. Banks of streams. Frequent. Ct.
Pyrola picta Sm. Frequent above 4,000 feet. S.
aphylla Sm. With the last. S. Ct.
Pterospora andromedeă Nutt. Not rare above 4,000 feet. S.
Apocynum androsæmifolium L. Common below 4,000 feet.
Phlox speciosa Pursh. Bondurant Mine. Local.
Gilia grandiflora. Frequent below 4,000 feet.
linearis. Scarce. S.
heterophylla. Common below 4,500 feet.
leptalea. Common above 4,000 feet. S.
divaricata Gray. Common below 4,500 feet.
ciliata Benth. Frequent. (This has now been found in the Mariposa district.)
Hydrophyllum occidentale Gray. Not rare above 4,500 feet. S.
Draperia systyla Torr. Common above 4,000 feet. S.
Cynoglossum occidentale Gray. Not rare above 4,500 feet. S.
Solanum Xanti Gray. Occasional below 4,500 feet.
Collinsia bartsiæfolia Benth. Below 4,500 feet. Common. Ct.
Species apparently undescribed. Above 4,000 feet. Snow Creek, Yosemite Turnpike. S.
Mimulus atropurpureus Kell. (Kelloggii Curran). Occasional below 5,000 feet.
angustatus Greene. Open grounds. White & Hatch's and above. S. Ct.
bicolor Benth. Open grounds below 4,000 feet. Common.
filicaulis Wats. Snow Creek. Once found.
moschatus Dougl. Wet places, frequent. S.
Veronica Americana Schwein. Wet grounds. Not rare. S.
Castilleia miniata Dougl. Frequent above 4,000 feet. S.
Audibertia humilis Benth. Devil's Gulch at 4,000 feet. Local.
Lophanthus urticifolius Benth. Banks of streams below 4,000 feet. Ct.
Polygonum imbricatum Nutt. Wet places, more common above. S.

Salix Lemmoni Bebb. Scarce in this zone, becomes frequent above. S.
flavescens Nutt. Sweetwater, 5,000 feet and above. S.
Quercus Breweri Engelm. Scarce in the chaparral below 5,000 feet. S.
Quercus dumosa Nutt. Devil's Gulch and above. S. Ct.
Corylus rostrata Ait. Frequent at 4,000 feet.
Asarum Lemmoni Wats. Snow Creek, 3,500 feet.
Comandra umbellata Nutt. Frequent in clayey soils up to 6,000 feet and above. S.
Torreya Californica Torr. Occasional. S. Ct.
Libocedrus decurrens Torr. S.
Abies concolor Lindl. S.
Pseudotsuga Douglasii Carr. S.
Pinus Lambertiana Dougl. S.
tuberculata Gordon. Occasional south of the Merced River, abundant north of it, always near the lower limit of this zone.
Corallorhiza Bigelovii Wats. Above 4,500 feet, frequent in the zone above. S.
Habenaria Unalaschcensis Wats. Common above 5,000 feet, occasional below. S.
Spiranthes Romanzoffiana Cham. Wet places, occasional. S. Ct.
Cephalanthera Oregana Reich. f. Occasional at 4,500 feet and above. S.
Iris Hartwegi Baker. Frequent. S.
Brodiæa multiflora Benth. Frequent below 4,000 feet.
Smilacina amplexicaulis Nutt. Frequent below 4,500 feet.
sessilifolia Nutt. Occasional especially above. S.
Lilium Washingtonianum Kell. Dry slopes, most abundant above 5,000 feet. S.
Calochortus nudus Wats. Frequent at 4,500 feet and above. S.
Prosartes trachyandra Torr. Occasional at about 4,500 feet.
Juncus dubius Engelm. Wet places, more abundant above. S.
Eleocharis Bolanderi Gray. Occasional in wet grounds. S.
Carex Geyeri Boott. Dry ground. Common above 4,500 feet. S.
bromoides Schk. Wet places at about 4,500 feet.
siccata Dew. Occasional below 4,000 feet.
Danthonia Californica Bolander. Most common above 4,000 feet. S. Ct.

Trisetum canescens Buckl. Frequent below 4,500 feet. Ct.
Aira elongata Hook. Same range as last. S. Ct.
Melica bromoides Gray. Rocky places below 4,000 feet. Devil's Gulch.
    Harfordi Bolander. Common. S.
    aristata Thurb. Frequent, especially above 4,000 feet. S.
Poa serotina Ehrh. Darrah. Local.
Festuca ovina L. var. duriuscula. Rocky stream beds at 4,500 feet and above. S.
Ceratochloa breviaristata Hook. Frequent. S.
Adiantum pedatum L. Wet rocks. S.
Cheilanthes gracillima Eaton. Rocks. Hite's Cove and above. Y. S.
    myriophylla Desv. Devil's Gulch, 3,500 feet and above. S.
Asplenium Filix-fœmina Bernhardi. Occasional. S. Ct.

Out of the 122 species enumerated above 75 or more than half extend into the subalpine region, while 24 are also found on the coast without appearing, as far as known, in the intervening territory. It is worth while to notice that of these 24 species 12 are limited to the redwood district which corresponds very closely with our coniferous belt and most of the others are probably stragglers from the same region.

Adding to these 122 species the 152 native and 40 introduced species which appear in the first list as also belonging to the coast region and the 44 native and 2 naturalized species which begin in the lower zone and extend into this, we have 360 as the number of known species belonging to the coniferous zone. The almost continuous pine forest, which, originally at least, covered the whole of this district, is no doubt the cause of the smaller number of species found here, by preventing that variety of condition and situation which is requisite for producing a great variety of vegetation. Out of the 317 native species found here 23, nearly 8 per cent., are so far as known limited to this zone.

# DISCOVERY OF A NEW GROVE OF SEQUOIA GIGANTEA.

BY WILLIAM W. PRICE.

Read before the California Academy of Sciences, August 1, 1892.

While stopping with Mr. C. F. Hoffman, Superintendent of the Red Point Mine on the Forest Hill divide, in Placer county, I heard rumors of a grove of big trees situated somewhere on the Middle Fork of the American River. I could find no one who had seen the trees, and I heard various accounts concerning them. Some said they were cedars, and others said they were something new, never before seen.

On June 20, in company with Mr. Karl Hoffman, I set out in search of the supposed grove. Our trail led over the mountains, across the Middle Fork of the American River, to the old, almost deserted mining camp of "Last Chance." Here, after some delay, we found a young miner, Mr. Ferguson, to guide us to the grove. He had been there some five years before, and knew all the country.

The grove was said to lie about eight miles from "Last Chance," and we found it fully that distance. Our trail, for the most part, lay along heavily wooded ridges, where only occasionally we had glimpses of the outside country. Away to the southeast rose the snowy slopes of Mt. Tallac, bordering Lake Tahoe. The trees, for the most part, were sugar pines—lordly fellows—and during the whole eight miles we saw only one cut tree. The miner and the "shake-hunter" had never despoiled this forest. Only a few chipmunks, jays and chickadees were heard to break the grand monotony of forest solitude.

On a slight rise of ground in the forest our guide left us and proceeded on alone. He came back in a short time with the welcome news that he had found the grove. We followed him some distance down the slope over a rich carpet of pine needles, until he came to a cañon—not a very steep one—cut into the slate formation. Then we came upon the grove, the most northern known, I believe, of *Sequoia gigantea.*

Only six trees are standing, and these do not spread over an acre or two of ground. This is, perhaps, the last stand made by *Sequoia gigantea,* and for a thousand years or more this grove has beaten back the fierce onslaughts of fire, storm and cold.

The two largest standing trees are about twelve feet in diameter, the four others are smaller. One fallen tree is twenty feet in diameter at the base, and twelve feet at fifteen feet from the roots. There are other small fallen trees. There had been, years before, a much larger fallen trunk—some said twenty-eight feet in diameter—but a fire had destroyed it. The height is not great, for sugar pines standing near tower above them.

This grove is situated in Placer county, about fifteen miles east of Forest Hill, on one of the streams flowing into the Middle Fork of American River. The altitude is about 5,000 feet.

The country is without any traveled trails, and all about the grove we saw tracks of California lions, bear, deer and other animals. The grove cannot be seen until a person is within a hundred yards, for the heavy-wooded cañon sides close all about it. This, perhaps, accounts for its being so long unknown to scientists. But to the old prospectors it has long been known, for on the bark of alders growing along the creek are cut the dates of 1860, 1862, 1868, 1872, 1880, 1892, and others. I had only an hour to observe the surroundings and take measurements, so this account is very meager. I hope soon to make a more thorough examination of the "North Grove."

## TUBA.

BY EDWARD PALMER.

Tuba, a beverage which is very popular in the State of Colima, Mexico, is obtained from the cocoa palm by the following process.

The fruit-bearing stems at the time the flowers are forming have their tips cut off and a gourd—sometimes two or three—hung from each, so as to catch the sap which flows freely from the wounded ends. Twice daily the liquid is collected from the gourds, a very thin slice of the stem being removed at each visit, in order to maintain the flow of sap which would otherwise soon cease from the drying of the exposed surface.

These gourds are often a source of curiosity to travelers, who wonder not only of what use they are, but how the owner gets them there. The height and slenderness of the trees prevent the use of a ladder, and the natives reach the tops by means of notches cut in

the trunk at convenient distances for stepping. By means of these and daily practice they ascend these trees almost with the ease and agility of monkeys.

The gourds are emptied by means of a short reed tube inserted just below the rim into a large flattened one fastened around the body of the climber by a strap. This gourd though very large is well adapted by its flattened shape for being carried about through the foliage of the tree. If insects or any foreign substance has accumulated in the gourds suspended in the trees they are cleaned out by means of a brush made of the interior fibrous wood of the tree which is carried in the belt for that purpose.

The knife used for freshening the ends of the shoots is much like the one used by shoemakers for trimming leather. It is sharpened on a piece of wood shaped like a whetstone with a handle. On the flat, smooth surface of this piece of wood sand is strewn and the blade being dexterously drawn a few times over its surface is sufficiently sharpened for the purpose. The flowering ends yield tuba twice daily for a year.

Tuba in the fresh state much resembles the liquid from the Agave before it becomes pulque. It is very refreshing and nutritious and has a slight taste of cocoanut, but in six hours fermentation sets in, in twelve hours it is as strong as old cider, by twenty-four hours acetic fermentation begins.

In order not to lose tuba when fermentation is far advanced many different things are added to it, and different flavors thereby given.

Some persons drink it when as strong as whisky, while others will mix the fermented juice with fresh so as to modify its strength and render it salable and to many, very palatable, but the form which commands the admiration of those who like to be under the influence of strong drink is known as

### TUBA COMPOSTURA.

This is made by adding to the fermented tuba one or more of the following articles: pineapples, lemons or onions in slices, bruised pods of chile or sticks of cinnamon; these being allowed to remain in the tuba for a short time add their flavor and strength to the mixture.

A favorite drink with many is made by adding cinnamon and ground almonds to the old tuba.

These composition drinks are sold at double the price of the fresh tuba, but though much used and highly intoxicating delirium tremens is of rare occurrence.

The venders of tuba or "Tuberos" as they are called, are found in the markets and in certain other places about the streets of Colima drawing thirsty crowds who seem to have preference for the tuba offered for sale by this or that person. The cry of the tubero as he goes about the streets is a familiar one often eagerly responded to. He is an object of curiosity to strangers, wearing a yoke upon his shoulders with a rope depending from each end sustaining by hooks, large gourds filled with tuba. Immediately below the rim of these gourds pieces of reed are inserted. These serve as spouts for pouring the tuba and also to carry the small vessels made of halves of gourds of different sizes, in which the tuba is retailed. These small vessels are pierced and a string passed through, by which they are suspended from the spout when not in use. There is also carried hanging from the spout a strainer which looks like a large wooden spoon full of holes, this is to remove any foreign substance which may appear on the surface of the tuba as the vender wanders to and fro offering to his customers the smallest gourd full of the drink for a cent and the largest one for two cents.

## A CHECK-LIST OF THE WATER BIRDS OF CALIFORNIA.

BY WALTER E. BRYANT.

While engaged upon some writing pertaining to the birds of California, I have found it convenient to have a list of the known species readily accessible, and have found Mr. Belding's "Land Birds of the Pacific District" so necessary that I was obliged to prepare a list of the water birds to supplement it. In this connection I have consulted all available records, and have received information regarding several species from Mr. Belding and Dr. J. G. Cooper. I have also compared it with a list compiled by Mr. Palmer two years ago. The publication of the "Water Birds of the Pacific District" having been deferred for lack of fuller information regarding the distribution of species and the times of their arrival and departure, it is hoped that those having the opportunity will give closer attention to the water birds, and make known their observations. I

should be pleased to learn of any authentic additions to this list. The species about whose occurrence and distribution in California less is known have been indicated by a (*). In regard to the geese which occur in this State, see Mr. Belding's article in the present number.

There is no record of the occurrence of the tropic bird *(Phaëthon æthereus)* beyond the doubtful one of a skull having been found on the coast of Marin County more than twenty years ago. Mr. Anthony has noted the species near Cape Colnett, and northward, probably.

1. ÆCHMOPHORUS OCCIDENTALIS (Lawr.)
2. COLYMBUS HOLBŒLLII (Reinh.)
3. COLYMBUS AURITUS Linn.
4. COLYMBUS NIGRICOLLIS CALIFORNICUS (Heerm.)
5. PODILYMBUS PODICEPS (Linn.)
6. URINATOR IMBER (Gunn.)
7. URINATOR PACIFICUS (Lawr.)
8. URINATOR LUMME (Gunn.)
9. LUNDA CIRRHATA Pall.
10. CERORHINCA MONOCERATA (Pall.)
11. PTYCHORAMPHUS ALEUTICUS (Pall.)
12. BRACHYRAMPHUS MARMORATUS (Gmel.)

*13. BRACHYRAMPHUS HYPOLEUCUS Xantus.

14. CEPPHUS COLUMBA Pall.
15. URIA TROILE CALIFORNICA (Bryant).

*16. URIA LOMVIA ARRA (Pall.) A single individual of Pallas's murre has been recorded from San Francisco Bay, in winter, by Dr. Cooper. Proc. Cal. Acad. Sci. v, p. 414.

*17. STERCORARIUS POMERINUS (Temm.) (Bryant, Proc. Cal. Acad. Sci. 2d Ser. ii, 87.)

*18. STERCORARIUS PARASITICUS (Linn.)

*19. RISSA TRIDACTYLA POLLICARIS Ridgw.

20. LARUS GLAUCESCENS Naum.
21. LARUS OCCIDENTALIS Aud.

*22. LARUS ARGENTATUS SMITHSONIANUS Coues.

*23. LARUS CACHINNANS Pall.

24. LARUS CALIFORNICUS Lawr.
25. LARUS DELAWARENSIS Ord.
26. LARUS BRACHYRHYNCHUS Rich.

27. LARUS HEERMANNI Cass.
28. LARUS PHILADELPHIA (Ord.)
29. STERNA TSCHEGRAVA Lepech.
30. STERNA MAXIMA Bodd.
*31. STERNA ELEGANS Gamb.
32. STERNA FORSTERI Nutt.
*33. STERNA PARADISÆA Brünn.
*34. STERNA ANTILLARUM (Less.)
35. HYDRÒCHELIDON NIGRA SURINAMENSIS (Gmel.)
36. DIOMEDIA NIGRIPES Aud.
37. DIOMEDIA ALBATRUS Pall.
*38. DIOMEDIA MELANOPHRYS Boie. Hab. "Southern seas, especially South Pacific; casual off coast of California." Ridgway.
*39. THALASSOGERON CULMINATUS (Gould).
*40. PHŒBETRIA FULIGINOSA (Gm.) No authentic record for this State, but said to extend "north (casually?) to coast of Oregon." Ridgway.
*41. OSSIFRAGA GIGANTEA (Gm.) Same remarks as above.
*42. FULMARUS GLACIALIS GLUPISCHA Stejn.
*43. FULMARUS GLACIALOIDES (Smith).
*44. PUFFINUS CREATOPUS Coues.
*45. PUFFINUS GAVIA (Forst.) One record from Santa Cruz. Proc. Cal. Acad. 2d Ser. ii, 87.
*46. PUFFINUS GRISEUS (Gmel.) One record from San Francisco. Proc. Cal. Acad. 2d Ser. ii, 87.
*47. PUFFINUS CINEREUS (Gmel.) "Accidental off the coast of California." A. O. U.
*48. DAPTION CAPENSIS (Linn.) "Accidental on coast of California." A. O. U.
*49. OCEANODROMA FURCATA (Gmel.) (Palmer, Proc. Cal. Acad. 2d Ser. ii, 88.)
50. OCEANODROMA HOMOCHROA (Coues).
*51. PHALACROCORAX DILOPHUS CINCINATUS (Brandt).
52. PHALACROCORAX DILOPHUS ALBOCILIATUS Ridgw.
53. PHALACROCORAX PENICILLATUS (Brandt).
*54. PHALACROCORAX PELAGICUS ROBUSTUS Ridgw. (Sutter County. Belding.)
55. PHALACROCORAX PELAGICUS RESPLENDENS (Aud.)

56. PELECANUS ERYTHRORHYNCHOS Gmel.
57. PELECANUS CALIFORNICUS Ridgw.
*58. FREGATA AQUILA (Linn.)
*59. MERGANSER AMERICANUS (Cass.)
60. MERGANSER SERRATOR (Linn.)
61. LOPHODYTES CUCULLATUS (Linn.)
62. ANAS BOSCHAS Linn.
63. ANAS STREPERA Linn.
*64. ANAS PENELOPE Linn. (Forest and Stream, xxvi, 426. Auk, iii, 4, 490.)
65. ANAS AMERICANA Gmel.
66. ANAS CAROLINENSIS Gmel.
*67. ANAS DISCORS Linn. Only five specimens are known to have been taken in California. Zoe, ii, 2, 97 and 128.
68. ANAS CYANOPTERA Vieill.
69. SPATULA CLYPEATA (Linn.)
70. DAFILA ACUTA (Linn.)
71. AIX SPONSA (Linn.)
72. AYTHYA AMERICANA (Eyt.)
73. AYTHYA VALLISNERIA (Wils.)
74. AYTHYA MARILA NEARCTICA Stejn.
75. AYTHYA AFFINIS (Eyt.)
76. AYTHYA COLLARIS (Donov.)
77. GLAUCIONETTA CLANGULA AMERICANA (Bonap.)
78. GLAUCIONETTA ISLANDICA (Gmel.)
79. CHARITONETTA ALBEOLA (Linn.)
*80. CLANGULA HYEMALIS (Linn.)
*81. HISTRIONICUS HISTRIONICUS (Linn.)
*82. SOMATERIA SPECTABILIS (Linn.)
83. OIDEMIA AMERICANA Sw. & Rich.
84. OIDEMIA DEGLANDI Bonap.
85. OIDEMIA PERSPICILLATA (Linn.)
86. ERISMATURA RUBIDA (Wils.)
87. CHEN HYPERBOREA (Pall.)
*88. CHEN ROSSII (Baird).
89. CHEN CÆRULESCENS (Linn.)
90. ANSER ALBIFRONS GAMBELI (Hartl.)
91. BRANTA CANADENSIS HUTCHINSII (Sw. & Rich.)
92. BRANTA CANADENSIS OCCIDENTALIS (Baird).

93. BRANTA CANADENSIS MINIMA Ridgw.
94. BRANTA NIGRICANS (Lawr.)
*95. PHILACTE CANAGICA (Sevast.) (Townsend, Auk, iii, 4, 490.)
96. DENDROCYGNA FULVA (Gmel.)
97. OLOR COLUMBIANUS (Ord).
*98. OLOR BUCCINATOR (Rich.)
99. PLEGADIS GUARAUNA (Linn.)
*100. TANTALUS LOCULATOR Linn.
101. BOTAURUS LENTIGINOSUS (Montag.)
*102. BOTAURUS EXILIS (Gmel.)
103. ARDEA HERODIAS Linn.
104. ARDEA EGRETTA Gmel.
105. ARDEA CANDIDISSIMA Gmel.
106. ARDEA VIRESCENS FRAZARI Brewst.
107. NYCTICORAX NYCTICORAX NÆVIUS (Bodd.)
108. GRUS MEXICANA (Müll.)
109. RALLUS OBSOLETUS Ridgw.
110. RALLUS VIRGINIANUS Linn.
111. PORZANA CAROLINA (Linn.)
*112. PORZANA NOVEBORACENSIS (Gmel.)
*113. PORZANA JAMAICENSIS (Gmel.)
*114. PORZANA JAMAICENSIS COTURNICULUS Baird. Extremely doubtful if ever found on Farallon Is., or in California. (Cf. Ridgway, Proc. U. S. Nat. Mus. xiii, No. 828, pp. 309–311.)
*115. GALLINULA GALEATA (Licht.)
116. FULICA AMERICANA Gmel.
117. CRYMOPHILUS FULICARIUS (Linn.)
118. PHALAROPUS LOBATUS (Linn.)
119. PHALAROPUS TRICOLOR (Vieill.)
120. RECURVIROSTRA AMERICANA Gm.
121. HIMANTOPUS MEXICANUS (Müll.)
122. GALLINAGO DELICATA (Ord).
123. MACRORHAMPHUS SCOLOPACEUS (Say).
*124. TRINGA CANUTUS Linn. (Townsend, Proc. U. S. Nat. Mus., 1887, 198.)
*125. TRINGA MACULATA Vieill.
*126. TRINGA FUSICOLLIS Vieill. (Bryant, Auk, iv, 1, 78.)
127. TRINGA MINUTILLA Vieill.

128. Tringa alpina pacifica (Coues).
129. Ereunetes occidentalis Lawr.
130. Calidris arenaria (Linn.)
131. Limosa fedoa (Linn.)
132. Totanus melanoleucus (Gmel.)
*133. Totanus flavipes (Gmel.)
*134. Totanus solitarius cinnamomeus Brewst.
135. Symphemia semipalmata inornata Brewst.
136. Heteractitis incanus (Gmel.)
137. Actitis macularia (Linn.)
138. Numenius longirostris Wils.
139. Numenius hudsonicus Lath.
140. Charadrius squatarola (Linn.)
141. Charadrius dominicus Müll.
142. Ægialitis vocifera (Linn.)
143. Ægialitis semipalmata Bonap.
144. Ægialitis nivosa Cass.
145. Ægialitis montana (Towns.)
*146. Aphriza virgata (Gmel.)
147. Arenaria interpres (Linn.)
148. Arenaria melanocephala (Vig.)
149. Hæmatopus palliatus Temm.
150. Hæmatopus bachmani Aud.

## ADDITIONS TO THE BIRDS OF THE GRAY'S HARBOR REGION, WASHINGTON.

BY SAM HUBBARD, JR.

Having been a resident of Gray's Harbor, Washington, for two years, viz.: from August, 1889, to 1891, I am able from personal observation to add a few species to the number observed by Mr. R. H. Lawrence, as set forth in his very interesting article in the January *Auk*, entitled: "A Preliminary List of the Birds of the Gray's Harbor Region, Washington." There are doubtless many other species observed and noted at the time, that have been left out of my incomplete list.

Gray's Harbor is the estuary or enlarged mouth of the Chehalis River. It is in the shape of a pear; the stem being the Chehalis River and the seed end being the entrance into the ocean. Three

rivers flow in from the north, viz.: The Wishkah, Hoquiam and Humptulips, and two from the south: John's River and Elk River. The harbor is very shallow, and at low tide the mud flats extend over a mile from shore. There is also a large flat nearly ten miles long bare at low tide, between the north and south channels, locally known as the middle ground. This is composed of mud at the upper end and sand at the lower end, and affords much feed for countless numbers of shore and bay birds. I am satisfied that several species of sandpipers and waders can be found there not noted in either list.

During the winter time ducks are abundant and afford much sport. From January until April canvas backs are very plenty. They feed on young clams which they dive for when the tide is in. They decoy easily and large bags are made by the sportsmen, who hide in the roots of the big spruce snags, that have drifted out of the rivers, and lodged on the mud flats.

Many ocean birds are driven in by storms and seek refuge in the harbor. As some of these outside birds are not familiar to me I have doubtless passed over a few that can be found in Gray's Harbor at any time during the winter.

Land birds, in comparison with other places I have been, are scarce. Ruffed and dusky grouse are comparatively plentiful, and also the robin, varied thrush and rusty song sparrow.

I made two trips into the Olympic Mountains by the way of Quinault Lake. On the last trip I went to the summit of the divide on the extreme head waters of the east fork of the Quinault. Birds were very scarce; in fact in the dense, damp woods of that region, life of any kind is scarce. We would tramp for hours and not see a living, breathing thing; not an ant, a bee, or an insect of any kind; not a squirrel or a bird, nothing but a vast wilderness of trees. When we reached the summit we were above the timber line, and there we found an open country covered with a beautiful growth of fresh green grass. The scent of wild flowers was in the air, humming birds and honey bees were darting about here and there, beautiful little cascades and clear mountain lakes pleased the eye, and everywhere nature appeared in her wildest and loveliest form.

1. ——— *Colymbus* sp.? Common in winter.
2. Pacific Loon. *Urinator pacificus?* Abundant.
3. ——— *Sterna* sp.? Common in winter.

4. Black-footed Albatross. *Diomedia nigripes.* Rare, driven in by storms.

5. California Brown Pelican. *Pelecanus californicus.* Tolerably common.

6. Hooded Merganser. *Lophodytes cucullatus.* Tolerably common.

7. "Whale Bird." *Puffinus* sp.? An ocean bird occasionally driven in by storms. Thousands of these birds fly in a continuous line up and down the coast, about a mile out at sea.

8. Green-winged Teal. *Anas carolinensis.* Common in winter.

9. Cinnamon Teal. *Anas cyanoptera.* Common in winter.

10. Shoveller. *Spatula clypeata.* Tolerably common.

11. Pintail. *Dafila acuta.* Between Gray's Harbor and Shoalwater Bay is a stretch of low, swampy ground called Cranberry Bog. Some few mallards breed in there, and I think also an occasional sprig and teal.

12. Red-head. *Aythya americana.* Rare.

13. Old-squaw. *Clangula hyemalis.* Tolerably common in winter.

14. Surf Scoter. *Oidemia perspicillata.* Very abundant, particularly on ocean beach. Residents along the beach claim that when these birds get washed ashore it is impossible for them to get out to sea again, owing to the pounding of the surf on the beach. My own observation tends to confirm this report.

15. Lesser Snow Goose. *Chen hyperborea.* During migrations.

16. American White-fronted Goose. *Anser albifrons gambeli.* During migrations.

17. California Clapper Rail. *Rallus obsoletus.* Saw one individual.

18. Virginia Rail. *Rallus virginianus.* Rare.

19. American Coot. *Fulica americana.* Abundant.

20. Long-billed Dowitcher. *Macrorhamphus scolopaceus.* Tolerably common.

21. Sanderling. *Calidris arenaria.* Common in winter and late into spring on ocean beach; feed on sand fleas and arrive at the season when their food is plentiful.

22. Marbled Godwit. *Limosa fedoa.* Common.

23. Greater Yellow-legs. *Totanus melanoleucus.* Tolerably common.

24. Western Willett. *Symphemia semipalmata inornata.* Very common.

25. Killdeer. *Ægialitis vocifera.* Common.

26. Mourning Dove. *Zenaidura macroura.* Have seen a few: rare near Montesano.

27. Turkey Vulture. *Cathartes aura.* Tolerably common.

28. Marsh Hawk. *Circus hudsonius.* Abundant.

29. ——— *Accipiter* sp.? Either Cooper's or the sharp-shinned hawk is quite common.

30. Western Red-tail. *Buteo borealis calurus.* Tolerably common. Several seen near Montesano.

31. Duck Hawk. *Falco peregrinus anatum.* Rare. Saw one in winter on Damon's Point catch a buffle-head duck.

32. Short-eared Owl. *Asio accipitrinus.* Tolerably common on the marshes.

33. Kennicott's Screech Owl. *Megascops asio kennicottii.* Had one alive which I took to be this variety.

34. White-headed Woodpecker. *Xenopicus albolarvatus.* Rare.

35. Pileated Woodpecker. *Ceophlœus pileatus.* One or two seen an Hoquiam River in dense timber.

36. Lewis's Woodpecker. *Melanerpes torquatus.* Tolerably common.

37. Western Nighthawk. *Chordeiles virginianus henryi.* Common in Chehalis Valley.

38. Black Swift. *Cypseloides niger.* Saw one flying over Quinault Lake that I took to be this species.

39. Kingbird. *Tyrannus* sp.? Common in Chehalis Valley.

40. Black Phœbe. *Sayornis nigricans.* Common in Chehalis Valley.

41. Clarke's Nutcracker. *Picicorvus columbianus.* Saw one or two flocks of these birds in the dense woods between Hoquiam and Quinault Lake. They are about the only birds to be seen in the depths of the woods. They feed on fir tufts and cones. They are rather silent.

42. Western Meadow Lark. *Sturnella magna neglecta.* Tolerably common resident.

43. Western Lark Sparrow. *Chondestes grammacus strigatus.* Common in Chehalis Valley.

44. Oregon Towhee. *Pipilo maculatus oregonus.* Tolerably common, particularly in Chehalis Valley and near Montesano.

45. Purple Martin. *Progne subis.* Common in Chehalis Valley.

46. Cedar Waxwing. *Ampelis cedrorum.* Saw several flocks of from fifteen to twenty on the Hoquiam River.

47. Nuthatch. *Sitta* sp.? Quite a common bird in the woods.

48. Chickadee. *Parus* sp.? Tolerably common, in flocks at all seasons.

## ON THE NATURAL HISTORY OF THE FARALLON ISLANDS.

GEOLOGY AND BOTANY BY J. W. BLANKINSHIP.
ZOOLOGY BY CHARLES A. KEELER.

Thirty miles west of the Golden Gate, in the Pacific, are the Farallon Islands, composed of three groups, called the North, Middle and South Farallones, and various rocks and shoals. They have a general northwest and southeast trend, parallel with the coast, and from Noonday Rock on the North to the South Farallones is a distance of about eleven miles. All except the extreme southern are mere points of rock in the ocean, the largest being only 160 yards in diameter.

The South Farallon is nearly a mile in length from east to west, and about half that distance in its greatest width. Its greatest elevation is 343 feet, and upon this peak the lighthouse is situated. The island is visited each week from May to July by the eggers, but at other times it has only occasional communication with the shore by means of tugs and the lighthouse tender. It is chiefly noted as the largest sea-bird rookery on the Coast. The following notes refer only to the South Farallon Island, and as the result of a two-days' collecting excursion, can hardly claim to be more than a very general survey.

NOTES ON THE GEOLOGY.

The islands appear to be the projections of a granite ridge, which is elevated about 500 feet above the ocean floor. The granite is coarsely crystalline, much fissured and easily decomposed, and is mainly similar to that of Point Reyes peninsula. Sugar Loaf Rock, the northernmost extremity of the island, is a conglomerate of huge rounded boulders, and a 600-foot section of a similar sandstone is exposed at Point Reyes Light, immediately succeeding the granite.

Around the entire island, at an altitude of 50 feet above the present sea-level, an old coast line may be clearly distinguished, marked by numerous water-worn caves exactly similar to those now being eroded by the waves, and by a wave-cut terrace on the south and east sides of the island, which slopes gently from the 50-foot line to the water's edge. It is on this terrace that the dwellings of the island are situated. Great Arch Rock was excavated at this level.

There also appears to have been a short halt between this and the present sea-level, for at several points shallow and more recent caves are seen 27 feet above the sea, and a dim second terrace is shown on the west near the landing.

On the west side of Shubrick Point, on the northeast coast of the island, the caves marking the three shore-lines are found in nearly vertical position. Measurements made here showed the highest to be excavated to a distance of 186 feet, the second to about 25, and the one at the present sea-level to about 100 feet. It is said that there has been a noticeable elevation of the island in the last thirty years.

This uplift of the island reveals another interesting fact: The great wave-cut terrace is on the south and east sides, and varies from 300 yards in width on the former to about 75 on the latter, while the north and west shores are steep and precipitous. Now, the conditions being the same, the greatest amount of wave erosion is on the side of the prevailing winds, but, as is well known, the prevailing winds off the California coast are from the north and northwest. The observations of the Signal Service at Cape Mendocino and Point Reyes Light show, for monthly prevalence of winds, that 84 per cent. are from the north and northwest; even in winter, 75 per cent. are from these directions.

On the south shore of the island, near the dwellings, there are

fissures partly filled with a granitic conglomerate. Whether these fissures are natural, or were worn by the water, I was unable to determine. I also saw fragments of jasper and other rocks besides granite scattered about among the debris.

Mr. J. de la C. Posada informs me that about Carmel Bay, near Monterey, there are sea terraces at levels corresponding closely with those of the Farallones, and that a higher terrace is faintly outlined about 80 feet above the sea. This I may have overlooked at the Farallones. He found a conglomerate resting unconformably upon the granite and formed of materials eroded from it. This conglomerate is inclined at an angle of about 45°. I thought I could distinguish a marked dip toward the north in the conglomerate of Sugar Loaf Rock, but I was unable to make a close examination, owing to its separation from the island by a narrow channel, and to the roughness of the sea. The sandstone at Point Reyes Light appears to dip toward the south.

## BOTANY.

The season was too far advanced for a good collection. Many species were already dead, and only dry fragments could be obtained. It is probable that a collection in May would add several more species to the list. Most of the plants here enumerated were doubtless brought over with the hay and other supplies, while those not thus introduced are given as "native." Eight species were found only in a small garden plot, protected from the rabbits, and elsewhere would be speedily exterminated. A single fresh-water alga was seen but not collected. There are no trees or shrubs on the island.

The soil is composed of decomposed granite and guano. Springs are few and small. *Bæria maritima* and *Lepigonum macrothecum* are the chief food of the rabbits; at this time of the year there was little except the latter to maintain them, and many were dying of starvation.

Only one plant—*Bæria maritima*—has been long enough isolated to show variation for which specific rank has been claimed, and it is seriously questioned whether it has departed far enough from *B. uliginosa* to be considered even a variety. This is the "Farallon Weed." It grows abundantly earlier in the season, and is said to reach a length of two to four feet. It furnishes excellent pasturage, and is highly esteemed as "greens" by the inhabitants.

PHANEROGAMS—

Introduced.

* *Stellaria media* L.
*Cerastium viscosum* L.
† *Malva parviflora* L.
* *Erodium cicutarium* L'Her.
† *Trifolium microcephalum* Pursh.
† *Trifolium bifidum* Gray var. *decipiens* Greene.
† *Melilotus Indica* Allioni.
* *Medicago denticulata* Willd.
* *Sonchus asper* L.
† *Anagallis arvensis* L.
† *Polygonum aviculare* L.
† *Chenopodium album* L.
* *Polypogon littoralis* Smith.
† *Avena fatua* L.
* *Poa annua* L.
* *Festuca Myurus* L.
* *Hordeum murinum* L.

Native.

*Sagina occidentalis* Wats.
*Lepigonum macrothecum* Pursh.
*Lepigonum medium* Fries.
*Claytonia perfoliata* Donn.
*Tillæa minima* Miers.
*Erigeron glaucus* Ker.
*Psilocarphus tenellus* Nutt.
*Eritrichium californicum* DC.
*Phyllospadix Torreyi* Wats.
*Juncus bufonius* L.

FERNS—

*Aspidium munitum* Kaulfuss. Only a single specimen collected.

MOSSES—

*Funaria hygrometrica* Sibth. Abundant.

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* Well established. † In garden only.

LICHENS—

Determined by Mr. M. A. Howe, of the University of California.

*Theloschistes lychneus* (Nyl.) Tuck. var. *pygmaeus* Fr. On high rocks.

*Theloschistes* ——? Similar situations.

*Buellia petraea* (Flat., Koerb.) Tuck.? On rocks.

*Placodium* (not fruited). On rocks.

ALGÆ—

Determined by Dr. C. L. Anderson (Diatomaceæ omitted).

*Bryopsis plumosa* Lmx.
*Codium tomentosum* Slack.
*Monostroma quarternarium* Desm.
*Ulva latissima* L.
*Enteromorpha compressa* Le Jolis.
*E. clathrata* Ag.
*Cladophora scopæfornis* Rupr.
*C. uncialis* Fl. Dan.
*C. cartilaginea* Rupr.
*C. glomerata* Ag.
*Desmarestia ligulata* Lmx.
*Leathesia tuberiformis* Gray.
*Chordaria abietina* Rupr.
*Asperococcus sinuosus* Bory.
*Egregia Menziesii* (Ag.) Aresch.
*Laminaria Andersonii* Farlow.
*Alaria fistulosa* Post. & Rupr.
*Ptergophora Californica* Rupr.
*Macrocystis pyrifera* Ag.
*Nereocystis Lutkenana* Rupr.
*Fucus vesicculosus* L.
*F. fastigiatus* Ag.
*Halidrys osmundacea* Harv.
*Porphyra laciniata*=*P. vulgaris* Ag.

PORPHYRA NAIADUM Anderson, n. sp.—Fronds small, seldom more than 2 inches long and ½ inch wide, very thin, spatulate with short stipes, tapering quickly into a flat membrane, with slightly wavy entire margin; dark purple or maroon; cells small, structure fragile and rapidly decaying.

This little Porphyra I have found growing only on Zostera and Phyllospadix, but it probably grows on other plants, hence the name for the order to which these two plants belong, Naiadaceæ. Some small mollusks, in rasping for food on these plants, cause abrasions, in which the spores of this Porphyra find a place to adhere and grow, so that many of the stems and leaves of these Naiads are literally covered with the brownish-purple fronds. It may be found at all seasons, wherever these weeds grow, along the whole length of our California coast.

Heretofore it has been distributed as *Porphyra vulgaris*, but without much more reason than our early botanists had for placing all seaweed in the genus Fucus.

It adheres closely to paper, and retains its natural color pretty well when mounted.

P. NEREOCYSTIS Anderson, n. sp.*—Fronds 3 to 20 inches long and 1 to 3 inches broad, very thin and ribbon-like, with nearly even or slightly crinkled edges and a somewhat pointed or oval tip; stipes very short or entirely wanting; frond often divided, sending long sections from either side; color brownish-purple, often changing to a bright carmine-purple, with a soft, glossy surface. Cells smaller, but otherwise hardly different from *P. vulgaris* Harv.

This large and beautiful Porphyra is most frequently found, on this Coast, growing on the long stems of the Nereocystis, although not always confined to that plant. Frequently it is torn loose and comes ashore in the drift, but mostly in fragments. It also has been considered only a form of *P. vulgaris*. But its structure, color and form surely entitle it to a specific place.

It adheres well to paper, and is seldom found until past midsummer, when the long stems of Nereocystis are well grown.

*Ceramium diaphanum* Roth.
*Centroceras clavulatum* Ag.
*Microcladia Coulteri* Harv.
*M. borealis* Rupr.
*Ptilota asplenoides* Ag.
*P. plumosa* Ag.=*P. filicina.*
*P. densa* Ag.

* This was published — name only — in "List of California Marine Algæ," Zoe, ii, 221.

*Pikea Californica* Harv.
*Grateloupia Cutleriæ* Ktz.
*Farlowia compressa* J. Ag.
*Prionitis lanceolata* Harv. Several forms.
*P. Andersonii* Eaton.
*Gigartina radula* Ag.
*G. horrida* Farl.
*G. papillata* Ag.
*G. canaliculata* Harv.
*Endocladia muricata* Ag.
*Iridea laminarioides* Bory.
*Callophyllis variegata* Ktz.
*C. laciniata* Ktz.
*C. furcata* Farl.
*Gymnogongrus linearis* Ag.
*Rhodymenia palmata* Grev.
*Cordylecladia conferta* Ag.
*Plocamium coccineum* Lyngb.
*P. violaceum* Farl.
*Nitophyllum multilobum* J. Ag.
*N. Fryeanum* Harv.
*N. latissimum* Ag.
*N. Ruprechtianum* Ag.
*N. violaceum* J. Ag.
*N. Andersonii* Ag.
*Gelidium corneum* Lmx.
*G. cartilagineum* Grev.
*Rhodomela floccosa* Ag.
*Polysiphonia Baileyi* Ag.
*P. Woodii* Harv.
*P. parasitica* var. *dendroides* Ag.
*Laurencia pinnatifida* Lmx.
*Chylocladia ovalis* Hook. var. *Coulteri* Harv.
*Corallina officinalis* L.
*C. squamata* Ellis & Sol.
*Amphiroa Orbigniana* Harv.
*Melobesia amplexifrons* Harv.

ZOOLOGY.

The birds of the Farallon Islands have been collected and recorded until they are tolerably well known; but, so far as I am aware, no attempt has hitherto been made to collect representatives of all the forms of life resident upon this little group of rocks. The trip made by Mr. J. W. Blankinship and myself, on July 3, 1892, was limited by the necessities of the case to a stay of only two whole days upon South Farallon Island, but we availed ourselves of the opportunity to collect in all departments of natural history to the fullest extent possible. In so brief a stay it was manifestly impossible to do more than skim over the surface in most branches, but the lists, even in their incomplete form, may be of value in showing the character of the life of the spot. Larger collections might have been made of certain classes had not Mr. Blankinship devoted a large part of his time to the study of the geology and botany of the island, while I was engaged in observing the habits of the birds and in making collections of the young for future investigation.

The results of the survey were disappointing in one respect, viz.: that no evidence was obtained indicating that any of the animals of the islands have become differentiated from mainland forms. It may be that fuller collections, or more careful elaboration of the material obtained, would show some slight variations, although, if present at all, they are undoubtedly very incipient in nature. It would seem as if the wingless beetles and the one batrachian of the islands would be effectually isolated upon a bare rock thirty miles from the mainland, but it is impossible to say that these forms have not been accidentally introduced in recent times through the agency of man. Unfortunately, we have been unable to have some few of the spiders, insects, etc., identified, so these forms are necessarily omitted from the list.

Mr. Wm. E. Ritter named the two following radiates:

*Asterias ochracea.*

*Strongylocentrotus purpuratus.*

MOLLUSCA.

The following list of the mollusca thus far recorded from the Farallones has been kindly compiled by Dr. J. G. Cooper, from his published and unpublished lists, together with the collection of the expedition:

*Martesia intercalata* Cpr. (in Haliotis shells).
*Entodesma saxicola*, Baird.
*Psephis tellimyalis* Carp.
*Rupellaria lamellifera* Conr.
*Chama pellucida* Sby.
*Mytilus californianus* Conr. Abundant.
*Septifer bifurcatus* Reeve.
*Modiola modiolus* Linn.
*Axinæa subobsoleta* Carp.
*Hinnites giganteus* Gray. Edible.
*Placunanomia macroschisma* Desh.
*Tornatella punctocœlata* Carp.
*Cryptochiton stelleri*, Midd.
*Mopalia ciliata* Gould.
    *vespertina* Gould.
*Nuttalina scabra* Reeve.
*Ischnochiton magdalensis* Hinds.
*Leptochiton internexus* Carp.
*Acmæa testudinalis* Müll. var. *patina* Midd.
    *pelta* Esch. Abundant.
        var. *asmi* Midd.
        var. *pintadina* Gould.
    *persona* Esch.
    *scabra* Nutt. Rare.
    *spectrum* Nutt. One of the most abundant species living about the rocks.
    *mitra* Esch.
*Lottia gigantea* Gray. Tolerably common.
*Lepeta cæcoides* Carp.
*Gadinia reticulata* Sby.
*Fissurella volcano* Reeve.
*Glyphis aspera* Esch.
*Clypidella bimaculata* Dall.
*Haliotis cracherodii* Leach.
    *rufescens* Swains.
    *kamschatkana.*
    *assimilis* Dall.
*Phasianella compta* Gld. var. *pulloides* Carp.
*Leptothyra carpenteriana* Pilsbry.

*Chlorostoma funebrale* A. Ad. Very abundant.
*brunneum* Phil.
*montereyi* Kiener.
*Calliostoma costatum* Mart. Abundant.
*Margarita pupilla* Gould.
*lirulata* Carp.
*Crepidula adunca* Sby. Common.
*navicelloides* Nutt.
*Hipponyx antiquatus* Linn.
*Bittium filosum* Gld.
*armillatum* Carp.
*Littorina planaxis* Nutt. The commonest shell of the islands.
*scutulata* Gld. Much less common than the preceding, although found together.
*Lacuna solidula* Louen.
*unifasciata* Carp.
*Barleeia haliotiphila* Cpr.
*Trivia californica* Gray.
*Erato vitellina* Hinds.
*Conus californicus* Hinds.
*Odostomia inflata* Carp.
*Cerithiopsis tuberculata* Mont.
*Mitra maura* Swains.
*Amphissa corrugata* Rve.
*Purpura crispata* Chem.
*canaliculata* Duclos.
*Ocinebra lurida* Midd.
*interfossa* Carp.
*Cerostoma foliatum* Gmelin.
*Pedicularia californica* Newc.
*Fusus luteopictus* Dall.

Mr. Chas. Fuchs has kindly identified the Coleoptera as follows:
*Amara californica* Dej.
*aurata* Dej.
*Bradycellus californicus* Lec.
*Blechrus nigrinus* Mann.
*Tachycellus nitidus* Dej.
*Axinopalpus biplagiatus* Dej.
*Necrophorus nigritus* Mann.

*Hister Lecontei* Mars.
*Saprinus lugens* Er.
*Coniontis Eschscholtzii* Mann.
*Eleodes consobrina* Lec.

I am indebted to the courtesy of Mr. Jas. E. Benedict, of the National Museum, for the identification of the following Crustacea:

*Heterograpsus nudus* Dana.
*Pachygrapsus crassipes* Randall.
*Eupagurus hirsutiusculus* Dana.
*Ligia occidentalis* Dana.
*Idotea ? hirtipes* Dana.
*Pollicipes polymerus* Sowerby.
*Tetraclita porosa*, var. Gmelin.

The only batrachian of the islands has been previously recorded by Cope:

*Autodax lugubris.*

BIRDS.

Leaving the fisherman's wharf in San Francisco in the little one-masted boat of the Greek eggers early Sunday morning, July 3, we expected to arrive at the island early in the afternoon; but the fates decreed otherwise. We set sail with a high head-wind, and for a time birds were not to be thought of as we lay below deck in darkness, with an environment of choice odors evidently made on purpose to delight the heart (and stomach) of the novice at seamanship —a bloody liver dangling at our feet and pans of stale meat at our heads. This soon grew intolerable, and we insisted upon having the after hatch opened. Standing up and breathing the fresh sea air was better than being cooped up below, although the bucketfulls of water which were hurled into our faces every few minutes by those conspirators against our peace of mind, the wind and wave, might have been thought disagreeable by the over-fastidious. The fortunate possession of a rubber coat saved me from being completely drenched, and with the exception of the seepage from an occasional injudicious shower of spray running down my neck, and a pair of wet shoes, I kept tolerably dry. The case was otherwise with my companion, however: he had no rubber coat, and was accordingly soon compelled to go below, drenched and disconsolate.

The only bird noted in the bay and about the Golden Gate was

the California guillemot, which was fairly common. It would seem from an examination of the dead bird as if the guillemot must be a slow and clumsy flier, so small are the wings in proportion to the size of the body; but, when once started in the air, they fly with great swiftness, their sharply-pointed bodies cleaving the air like a spear, and their compact little wings whirring at a great rate. They were very tame, and allowed the boat to draw quite close before making any attempt to escape. Some would then dive with an impatient jerk, but the majority would start to fly. Apparently not having the time nor energy to lift their bodies out of the water, they would flap along on the surface, splashing and scuffling in a ludicrously frantic manner. Occasionally some peculiarly energetic individual would actually lift himself above the sustaining fluid and essay to fly, but, apparently blinded in his hurry to escape, would plunge directly at the first wave that happened to be slightly higher than usual, and literally fall all over himself in the most awkward manner imaginable. I noticed that whenever the bird dived the wings were thrown out, as if to assist in swimming, instead of being folded clôse to the body, as with most diving birds. Later observation confirmed the theory that the birds swim under water with their wings more than with their legs, for they may frequently be seen under water from the Farallon rocks using the wings in this manner. Indeed, the form of the wing is curiously analogous to the wing of a penguin, being shaped something like a flipper, and very stiff and compact. It is, of course, only an analogy, the penguin's wing being scaled, while the character of the guillemot's wing is due to the feathers. It seems not improbable, however, that the guillemot is gradually losing the power of flight, just as the great auk lost it, in order to gain greater freedom in swimming under water. Its difficulty in rising from the water and awkwardness in falling back into it would seem to argue in favor of this view, in spite of its swift flight in a gale of wind.

In all this digression it must not be forgotten that the wind is still blowing and our little craft tumbling about as it approaches the bar in Golden Gate. An occasional Brandt's cormorant would flap past, its long neck stretched far ahead of the clumsy black body, as if trying its best to part company with so slow a companion. As we get a little way out to sea, a large rock, slightly isolated from the mainland, is noticed completely whitened with the guano of this

species, indicating the presence of a large rookery. The wind, which had been uncomfortably brisk inside the bay, left us almost entirely after we were well out to sea, and we were soon rolling aimlessly about on the broad ocean swells, with only an occasional puff of wind to make the sails flap. Thus we spent the rest of the day. The night was varied by a dense fog closing in around us, and the cheerful tones of an old tin fog-horn, with responses from two or three neighboring vessels, lent a little life to the scene for a time. Not appreciating the bits of greasy fried liver upon which our captain and crew of two made their morning, noon and evening meal, bread and claret completing the bill of fare, we went supper-less to bed. On looking out early the next morning the dark, lead-colored water and foggy air looked cheerless enough, but we were consoled by the information that we were sailing under a good breeze directly towards our destination. Soon the North Farallones loomed up through the fog—little bare rocks, with the waves dashing against their sides. Presently midway rock was passed, and at last we were in sight of South Farallon. Almost before we know it the sail has been lowered, and we row past Sugar Loaf Rock into Fisherman's Bay, where the anchor is lowered and the fog-horn blown to summon the eggers on shore to send a skiff for us to land. As we lay at anchor in the little cove the sight was, indeed, a novel one. The rocks were of a light pinkish or cream color from the guano upon them, interspersed with patches of pale-green where some moss or lichen had taken root, apparently. Lower down, where the waves dash upon them, they were clean and almost black in color, while in beautiful contrast to their sombre hue the breakers were dashed into white foam and pale-green opaline tints. But the thing which interested us the most was the vast assemblage of birds. Every cranny upon the face of the rough granitic cliffs was alive with guillemots, uttering their characteristic note, some at rest, some fluttering and scrambling or bobbing their heads; the whole scene being one of indescribably weird animation, and unlike anything else imaginable, unless it be the witches in Faust on Walpurgis night. Here and there the black figure of a cormorant upon her nest was noticed, or one would fly by with a fish in her bill, headed toward her nest. An occasional puffin *(Lunda cirrhata)*, or sea parrot, as it is aptly called, would fly past the boat, with its immense odd bill of red and the big patch of white on the head in striking

contrast to the dark color of the body. By far the most familiar birds were the western gulls *(Larus occidentalis)*. They flocked about the boat in considerable numbers, displaying their beautiful dark slate-blue mantle and yellow bills with the scarlet patch near the tip. They were attracted by the refuse from the men's breakfast, which was thrown overboard in the cove. In spite of their fine plumage and graceful actions, they proved to be a disagreeable, noisy, quarrelsome bird.

After a half-hour of impatient waiting a skiff was lowered into the water from the sling in which it hangs from the rocks, and a man came out to land us, bags and baggage. Not until we were in the skiff bound for shore, and in the comparatively quiet waters of the cove, did I realize to its fullest extent the pleasures of a sea voyage by getting seasick; and then to lie down and watch my companion consume a good breakfast after a fast of thirty-six hours, and be able to join him only in spirit!

However, there was no time for lamenting the inevitable. Shortly after we had become established in our quarters at the residence of the head light-keeper, the eggers started to gather the eggs on the portion of the island known as West End, and we learned that it would be our only opportunity to visit that district, as the eggers object to disturbing the birds except just after they have plundered them.

The eggers had refused to allow us to take a gun to the islands, but we found two young men there from San Francisco, who had come on the tug, and were provided with that implement so necessary to the bird collector. One of them, Mr. H. M. Anthony, very kindly went with me and assisted in securing such birds as I desired.

As we started off, following the course of the eggers, the gulls were by far the most conspicuous and noisy birds seen. Their most common note may be expressed by the syllables *quock kuck kuck kuck*, uttered very rapidly in a low, guttural tone. Sometimes it was varied thus—*kuck kuck kuck ka*—the quality of tone being the same as in the first instance. Frequently a higher cry would be heard, which may be indicated by the letters *ki aa*, with a strong accent on the first syllable. Again, one would utter a rattling, guttural cry, which sounded like a man being throttled. The young were quite common about the rocks, white in color, everywhere spotted with dark dusky. At the approach of an enemy they would

run and attempt to squeeze into any little cranny in the rocks they happened to espy, but were very readily caught by hand. The nest is a simple affair composed of dry weeds, mostly *Bæria maritima*, and placed almost anywhere upon a rocky hillside. No nests were observed on the steep cliffs overhanging the sea, the favorite situation being a hillside of moderate slope. The eggs are remarkably well protected in color, and the nest itself is so trifling an affair that it may frequently be almost stepped upon without being discovered, unless the attention is especially directed towards finding it. The birds are extremely noisy and vociferous as long as an intruder remains in their territory, hovering over him in large numbers and swooping upon him with menacing cries and gestures. Altogether, one feels more comfortable when he gets off their preserves. But the birds are remarkably inconsistent, for they are inveterate plunderers themselves. As the eggers go about the rocks, starting all the birds from their nests, the gulls follow closely in their train, breaking every cormorant's egg which comes in their way and devouring the contents. They even manage to crack the tough shell of the guillemot's egg if any should be passed by the eggers.

Continuing our scramble up the rocks, we presently reached the summit of the west end, where a wonderfully grand spectacle was unfolded to view. We found ourselves on the very edge of a precipice with a sheer drop of several hundred feet, perhaps, to the sea, which was breaking on the rocks below. All about the rocky ledges were rows of guillemots, frequently huddled together in enormous numbers. I sat down and made rough sketches of the birds, illustrating some of the attitudes they assumed. While observing them, one which sat upon the topmost ridge stretched its neck out and, leaning over, looked down at the sea as if contemplating a plunge. Others were busy dressing their plumage, while now and then one would rise up and flap its wings and then settle down again. A group of the birds drawn from life is represented in Plate xviii. So large a concourse of these birds is a strange sight indeed, and one furnishing much food for reflection. Here we see the social instinct in one of its most primitive forms. A community of ants or bees is far in advance of an assemblage of sea birds. Here they live, each pair with a piece of property and home of their own, a little nook of rock with a single egg upon it; and the own-

ers have well-defined ideas of individual rights and the impropriety of "jumping claims." Mr. Walter E. Bryant, in his Birds and Eggs from the Farallon Islands,* suggests that the curiously pronounced pear shape of the guillemot's egg is "an all-wise provision * * * preventing it from rolling off of a slightly inclined plane"—by which he means, I suppose, that it has been brought about by natural selection. This is a very interesting observation regarding the significance of the shape of the egg, and certainly seems to be perfectly plausible. The color of the guillemot's egg is no less remarkable than the shape. No two individuals lay eggs exactly alike; in fact, there is probably no bird which displays so great a diversity with respect to color and markings as the guillemot. Still more interesting: one of the eggers, a man of intelligence and veracity, apparently, informed me that the same pair of birds always laid the same style of an egg. He said that on particular isolated ledges where only a single pair built he would invariably find one form of marking upon the egg. Thus, on taking the egg from some known spot on alternate days, he would observe it was invariably scrawled, or from some other nook constantly unmarked white, while a third cranny would yield an egg spotted in a particular way. If this observation be true it is of considerable interest, and may perhaps furnish a clue to the reason for the diversity of type in the eggs. With most birds the color of the egg varies but little from the type of the species, and we may accordingly infer that the particular color is of some use, and is preserved by natural selection. The form of the egg is frequently more variable than the color, but with the guillemot the reverse is the case. The shape is remarkably constant, and there seems to be a good reason why it should be so. But there appears to be an equally good reason why the color should be variable. In nesting in great numbers close together there might frequently be difficulty in keeping each pair's property distinct if all the eggs were alike, but this difficulty would be entirely obviated if each pair laid a different style of egg. Natural selection, then, would not tend to preserve any one type of marking, but would rather encourage as great diversity as possible. If a pair does always lay the same style of egg the birds would learn their own kind once for all. This would be especially useful if the

* Proc. Cal. Acad. Sci. 2d Ser. Vol. I, p. 35.

same pair mated year after year. The observation upon the constancy of the color of eggs of a single pair would need confirming by competent scientific authority, however, before it could be entirely credited.

As I sat sketching the guillemots on the crest of the rock, their curious habit of bowing was repeatedly noticed. The first one in a row will deliberately bow his head, perhaps once, or sometimes two or three times, followed in turn by each one in the assembly. What the purpose of this curious maneuver is I was utterly unable to make out. The explanation that naturally suggests itself is that it is in some way connected with the courting of the birds, although there was really nothing to confirm this view.

Brandt's cormorant was also very abundant upon this West End ledge, and nested there in large numbers. Between the eggers and the gulls the birds of this section have a hard time of it, however, and no young of either the guillemots or Brandt's cormorant were discovered. After securing specimens of the adult of these species, together with a stray puffin, we started on our return course, visiting the rookery of Farallon cormorants on the way. Drawings were made of the old birds in various attitudes, and of the young in the nest. Plate xix shows a group of the young, with adult in the distance. The young are about as ugly specimens as nature ever permits, the comparison to a black greasy kid glove being especially apt in describing them. They are almost destitute of feathers, a little dark fuzz here and there indicating where they will eventually appear, while the pin-feathers may have started as dark-colored quills. On approaching a nest of young they would open their immense mouths and stretch their necks angrily towards the intruder, uttering a low, hoarse, plaintive *kwa kwa kwa kwa kwa*. On drawing nearer the cries are louder and very violent, the birds squawking loudly. One nest that I observed particularly, contained two young, one much larger than the other. As we sat watching them at a short distance the older bird was noticed preening and caressing the younger with its bill—a notable example of brotherly or sisterly affection. When the younger bird was removed and transferred to the collecting basket, however, the older one, instead of manifesting a decent amount of grief over the loss of its companion, commenced preening and dressing its own greasy skin in the most unconcerned manner imaginable the moment its own safety

was no longer menaced. Mr. Anthony called my attention to the fact that the nests of Brandt's cormorant were decorated around the sides with fresh seaweed, while the Farallon and Baird's cormorant built their nests exclusively of dried weeds, principally *Bæria maritima.*

We also visited the nesting place of Baird's cormorant, and obtained specimens of the old and young. This bird is less common than the other two cormorants and less communistic in its habits. It appears to resort to steep cliffs upon which to build its nest, while the other two species build upon a sloping hillside, as a rule. One solitary Baird's cormorant was noticed sitting upon her nest on a little shelf of rock only about fifty feet above the booming surf, and completely isolated not only from other individuals of her own species but from all the other birds of the island. A lonely life indeed amid the wild desolation of nature. Figures 1 and 2 of Plate xxi indicate the differences in the bill of the Farallon and Baird's cormorant. The former has a considerably longer bill, and there is quite a well marked difference in shape, even at this early age. The color of the skin is also quite distinct in the two species, being almost black or dark slate colored in the Farallon, and a seal brown in Baird's.

The return from the morning's collecting trip was made under difficulties for we had so many birds to carry that we could barely walk under the weight of some twelve cormorants, together with a few guillemots, puffins and auklets. The afternoon of the "glorious Fourth" was consumed in making rough skeletons of some of the birds, and putting others away in alcohol, while the evening was devoted to writing up the notebook. The following morning was largely taken up with collecting the shells and other marine life among the rocks, together with some insects, but I also managed to visit the nesting place of the puffins *(Lunda cirrhata)*, and Cassin's auklet *(Ptychoramphus aleuticus)*. The steep rocky hillside in which they nested was composed of a sort of coarse shale-like granite in which there were many fissures offering a safe retreat for the birds. Peering into some dark cranny a puffin would be barely visible at the further end. I was immediately struck with the use of the conspicuous white patch upon the face as a socialistic recognition mark. Were it not for this the bird would be completely invisible from the entrance to the burrow, and it would doubtless be a matter of con-

siderable convenience in the social intercourse of the parent birds. It is a significant fact that the patch is white, as with the markings about the head in so many mammals that live in burrows. There is, however, another use in this white patch of the sea parrot. I noticed that the setting bird always faced the entrance to her retreat, exposing the white patch in full view. On seeing this special precautions were used in inserting the hand to prevent being bitten, for the bite of a puffin is a dangerous thing. It is quite evident that this white patch must serve as a warning for intruders to keep off, and is one of the few cases of warning colors among birds which have come to my notice.

A series of the young of Cassin's auklet was obtained, but the bird is nocturnal in habits so that very little was seen of the adult. Figure 3 of Plate xxi shows the young puffin's head, the bill, even at this early stage of development being greatly enlarged and transversely grooved. The bird is feathered when hatched, apparently, at least the youngest specimen obtained was completely so, and of a dark brown color. Figure 5 shows the head of Cassin's auklet. It may be recognized at the earliest age obtainable by the little upturned snub bill and the gray feet.

In size and general color the young of the pigeon guillemot is not unlike the young of Cassin's auklet, both being dark-brown in color; but the difference in the shape of the bill, as shown in Figure 4 of Plate xxi, is very marked, as is also the character of the feet. The throat of the guillemot is feathered, while in the auklet it is almost naked, and of a dark slaty color.

Mr. Anthony noticed Cassin's auklets nesting along the sides of one of the caves which he explored, which is quite an unusual habit with this species. I noticed that they also nest on level ground in crannies under loose rocks. At night, especially if the moon is up, the birds are very abundant and noisy. Their note resembles the creeking of a rusty gate, and may be represented by the syllables *creek a reek! creek a reek! creek a reek!* Another nocturnal bird is the ashy petrel (*Oceanodroma homochroa*). It is perhaps not so rare upon the island as it is difficult to find. Mr. Anthony obtained a large number of eggs and birds by systematically turning over rocks on a hillside where they were known to be found. The nest is frequently, though by no means invariably, indicated by the strong musky odor in its vicinity. The flight of the petrel was light, quick

and noiseless, reminding one somewhat of the flight of a bat. I did not hear any note uttered by the bird. The irrepressible gulls were also abroad at night and their note at that time sounded as a pensive wail indescribably weird and mournful as it mingled with the creeking of multitudes of auklets and the roar of the waves and wind whistling about the sharp points of rock.

There is but one other sea bird which nests about the islands of which no particular mention has been made—the pigeon guillemot *(Cepphus columba)*. It is very common, although never seen congregating in such immense numbers as the California. When sitting upon the rocks facing the observer it appears to be a very dark brown bird with conspicuous scarlet feet. This brilliant color is undoubtedly a recognition mark as is also the characteristic white patch on the wing which is conspicuous both when the bird is at rest and in flight. Plate xx represents a group of the birds, the attitudes having been taken from life. The most characteristic attitude of the bird is an erect posture, with the entire foot upon the ground. Frequently it will squat flat down among the rocks, however. They may frequently be seen with fishes in their bills, but I was unable to determine whether for their own use or to feed the young. When anyone approaches they sit with their long slender bills wide open and utter a high pensive long drawn out squeak—*peeeeeeeeie*. Young birds were obtained from crannies in the rock, in much the same sort of place as the auklets breed.

In the foregoing account of the water birds breeding upon the Farallons little or nothing has been said of the eggs both because they have all been described and because my own efforts were directed towards obtaining the young birds and such few eggs as were found well incubated.

Only two land birds nest upon the island, the raven *(Corvus corax sinuatus)*, which is very rare but undoubtedly breeds there, and the rock wren *(Salpinctes obsoletus)*, which is extremely abundant and nests all over, at least the lower parts of the island. The black turnstone *(Arenaria melanocephala)*, was fairly common along the beach. No evidence of their breeding was discovered but it is a little remarkable that they have been recorded by Mr. Emerson*

*Bryant l. c. p. 44.

in May, June, July and August, if they do not nest there. But one addition to the list of birds published in Mr. Bryant's catalogue was made, the Carolina rail *(Porzana carolina)*. A specimen was shot by Mr. W. A. Beeman, head light-keeper, in August, 1890, and is now in his possession mounted.

It will not be necessary to detain the reader with a narrative of the remainder of the trip, as nothing new in the way of birds was discovered. Early on the morning of July 6, we received news that the egg boat was ready to return, so after hastily packing we soon found ourselves pitching about in a rough sea, en route for San Francisco.

It may be fitting to close this account of the birds of the Farallones with a word on their geographical distribution in general. The water birds which nest upon these isolated rocks are such species as frequent the rocky islands and mainland of the north Pacific, as far north as Alaska. Indeed, the Farallones appear to mark the southern limit of breeding range of one or two species. Mr. Clark P. Streator* has noted the tufted puffin, Cassin's auklet, western gull, pigeon guillemot and the three cormorants of the Farallones breeding upon the Santa Barbara Islands. Of this number Mr. Bryant, in his Catalogue of the Birds of Lower California† records Cassin's auklet as breeding as far south as San Geronimo Island (Anthony), and the western gull as breeding on Todos Santos Islands off Ensenada and upon the Island of San Pedro Martir (Goss). The California guillemot I do not find recorded as breeding south of the Farallons. All three cormorants are found in Lower California and probably all breed from there north to Washington as stated in the A. O. U. Check List.‡ The ashy petrel has not been recorded, I believe, as breeding at any point except the Farallones. The com-

*O. & O. xiii, pp. 53-54.

†Proc. Cal. Acad. Sci. 2d Ser. vol. ii, pp. 250-251.

‡pp. 110-111.

parative distribution of the birds of the Farallones with regard to their breeding range may be graphically represented as follows:

| | | | | |
|---|---|---|---|---|
| Cassin's Auklet. | Pigeon Guillemot.<br>Tufted Puffin. | California Guillemot. | | Alaska. |
| | | | | Northern U. S. |
| | | Western Gull.<br>Brandt's Cormorant.<br>Farallon "<br>Baird's " | Ashy Petrel | FARALLONS. |
| | | | | Santa Barbara Isls. |
| | | | | Lower California. |

MAMMALS.

As might be expected there are no land mammals native to the Farallones. Rabbits have been introduced and have multiplied until they are extremely abundant and very tame. They are of every imaginable shade of color from black, through brown and gray to white, sometimes clear, frequently mottled. During the dry season, the light-keeper informs me, they die off in great numbers owing to lack of food.

Sea Lions *(Eumetopias stelleri)*, are common, especially upon the North Farallones. Mr. Beeman informs me that fur seals *(Callorhinus ursinus)*, occasionally visit the islands during the winter months and also the leopard seal *(Phoca vitulina)*.

NOTE.—There are two more species which were overlooked and which should be added to the list of California water birds published in this issue.

NUMENIUS BOREALIS (Forst.) Recorded from San Diego by Mr. Holterhoff. (Auk, i, 4, 393.)

XEMA SABINII (Sab.) A specimen (No. 379) is in the collection of the California Academy of Sciences. It was taken on San Francisco Bay in October, 1889, and was identified by Mr. Belding.

W. E. B.

# THE NOMENCLATURE OF PLANTS.

BY KATHARINE BRANDEGEE.

This subject is at present attracting a large amount of the attention of systematic botanists. An international botanical congress is to be held in Genoa next month, at which the questions will probably be freely discussed, although, from the known wide diversity of opinion, agreement is hardly to be hoped for. Of one thing we may be assured beforehand — the so-called "Kew rule," or rule of convenience, so tenaciously held in certain quarters, and reaffirmed in a posthumous letter by Dr. Watson, will have a numerically scant following. It is quite sufficient to imagine the ghastly state of affairs if Kuntze, in addition to his other liberties, had taken this and renamed the species according to fancy.

The following circulars, the first to botanists in general, the second to the botanists of America, have been sent out for the signatures of those who agree with them:

"PROPOSITIONS TO AN AMENDMENT OF THE 'LOIS DE NOMENCLATURE BOTANIQUE.'

Since the time of Linnaeus botanists have continually endeavored to gain a uniform nomenclature, and these endeavors were completely justified on account of an easier mutual understanding. We know very well that certain differences will always remain, because the decision on some questions only depends on the author's subjective opinion. But we hope that a gradual and continual reformation will bring an essential improvement. O. Kuntze's Revisio generum has raised an evident perturbation, and will cause a complete confusion; therefore, we thought it necessary to propose the following four resolutions, which refer only to the genera:

I. The starting point of the priority of the genera, as well as the species, is the year 1752, resp. 1753.

II. Nomina nuda and seminuda are to be rejected. Pictures alone, without diagnoses, do not claim any priority of a genus.

III. Similar names are to be conserved if they differ by ever so little in the last syllable; if they only differ in the mode of spelling, the newer one must fall.

IV. The names of the following larger or universally known genera are to be conserved, though after the strictest rules of pri-

ority they must be rejected; in many of them the change of the names now used is by no means sufficiently proved:

Ad 1. After Alph. de Candolle had proposed to take the year 1737 as the starting point of the priority of genera, many botanists had acknowledged it. But we think that the turning point from the ancient botany to our modern science rests in the introduction of the binominal nomenclature. Therefore, we propose, after a previous communication with Alph. de Candolle, to remove the starting point for both the species as well as the genera as far as to the year 1753, resp. 1752, date of the species plantarum ed. I. (1753), with the IV. ed. of the genera plantarum (1752). Before that time the scientific position of Linnaeus is not superior to Tournefort, Rivinus and many other botanists, who often had described and segregated the genera more exactly than he did.

Ad 2. Many genera have been founded on a picture only, without a diagnosis. No doubt by means of it a species sometimes can clearly be made out and recognized; and if the picture is a good one, all the characteristics of the plant can be observed. But a picture can never show the special characteristics alone which raise the genus above the other of its affinity. A genus only gains priority by a verbal diagnosis, and nomina nuda and seminuda are to be rejected; therefore, the following works cannot claim a right of priority; Rumphius, Herbarium Amboinense (1741–1755), Burmann, Flora Indica (1768), Patr. Browne, History of Jamaica (1756), Lamarck, Illustration des genres pro parte, etc.

Ad 3. There are to be conserved *Adenia* as well as *Adenium*, *Acnista* as well as *Acnistus*, *Alectra* as well as *Alectryon*, *Apios* as well as *Apium*, *Rubia* as well as *Rubus*, *Bellis* as well as *Bellium*, *Chloris* as well as *Chloraea* and *Chlora*, *Glyphaea* as well as *Glyphis* and *Glyphia*, *Calopogon* as well as *Calopogonium*, *Atropa* as well as *Atropis*, *Galax* as well as *Galaxia* and *Galactia*, *Danaë* as well as *Danais*, *Drimia* as well as *Drimys*, *Glechoma* as well as *Glechon*, *Hydrothrix* as well as *Hydrotriche*, *Micranthus* as well as *Micrantheum*, *Microtea* as well as *Microtus*, *Platystemma* as well as *Platystemon*, *Silvaea* as well as *Silvia*, etc.; we doubt that there is any scholar who will confound them. On the contrary, *Tetraclis* and *Tetracleis*, *Oxythece* and *Oxytheca*, *Epidendrum* and *Epidendron*, *Oxycoccus* and *Oxycoccos*, *Asterocarpus* and *Astrocarpus*, *Peltostema* and *Peltistema*, are only different modes of spelling the same word, and the newer one is to be refused if they name different genera.

Ad 4. The impulse that led to the acknowledgment of the right of priority was only the vivid desire to create a stable nomenclature. If we see that by the absolute and unlimited observance of the principle we probably gain the contrary of what we intended, we, who have ourselves made the rules of priority as a law, have the right to amend the latter. Therefore, we present a list of genera that have more than a merely scientific interest, or that are very large, and we propose to conserve them in spite of the rules of priority, in order to avoid a general confusion by the change of many thousand names.

The Committee—P. Ascherson, A. Engler, K. Schumann, I. Urban.

We agree to the four resolutions—A. H. Berkhout, R. Beyer, C. Bolle, R. Büttner, U. Dammer, B. Frank, A. Garcke, E. Gilg, M. Gürke, P. Hennings, O. Hoffman, L. Kny, E. Koehne, G. Krabbe, F. Kränzlin, L. Krug, M. Kuhn, G. Lindau, E. Loew, P. Magnus, F. Niedenzu, F. Pax, H. Potonié, O. Reinhardt, R. Ruthe, S. Schwendener, P. Taubert, G. Volkens, O. Warburg, A. Winkler, L. Wittmack, E. Wunschmann.

| Num. spec. | Nomina Conservanda. | Nomina Rejicienda. |
|---|---|---|
| 5 | Erophila DC. (1821) | Gansbium Ad. (1763) |
| 50 | Jonidium Vent. (1803) | Calceolaria Löffl. (1758) |
| 4 | Spergularia Pers. (1805) | Tissa v. Buda Ad. (1763) |
| 40 | Ternstroemia Thbg. (1794) | Mokofua Ad. (1763) |
| 80 | Malvastrum A. Gr. (1849) | Malveopsis Prsl. (1844) |
| 11 | Cola Schott et Endl. (1832) | Edwardia Raf. (1812) |
| 17 | Podalyria Lam. (1795) | Aphora Neck. (1790) |
| 200 | Oxytropis DC. 1802) | Spiesia Neck. (1790) |
| 155 | Desmodium Desv. (1813) | Meibomia Heist. ex Fabr. (1763) |
| 80 | Adesmia DC. (1825) | Patagonium Schrk. (1808) |
| 55 | Barringtonia Forst. (1775) | Huttum Ad. (1763) |
| 70 | Sonerila Roxb. (1820) | Cassebeeria Dennst. (1818) |
| 30 | Rhipsalis Pers. (1805) | Hariota Ad. (1763) |
| 10 | Paederia Linn. (1767) | Houdbesseion Ad. (1763) |
| 16 | Liatris Schreb. (1791) | Laciniaria Hill (1762) |
| 140 | Mikania W. (1803) | Willoughbya Neck. (1790) |
| 115 | Blumea DC. (1833) | Placus Lour. (1790) |
| 28 | Euryops Cass. (1818) | Jacobaeastrum Man. (1751) |
| 24 | Gazania Gärtn. (1791) | Meridiana Hill (1761) |
| 160 | Cirsium Scop. (1761) | Cnicus et Carduus L. 1753 ex. p. |
| 80 | Scaevola Linn. (1772) | Lobelia Ad. (1763) |
| 50 | Armeria Willd. (1807) | Statice Fabr. etc. (1759) |
| 120 | Statice Willd. (1807) | Limonium Fabr. etc. (1759) |
| 3 | Chonemorpha Don (1837) | Bellutakaka Ad. (1763) |
| 50 | Oxypetalum R. Br. (1809) | Gothofreda Vent. (1803) |

| Num. Spec. | Nomina Conservanda. | Nomina Rejicienda. |
|---|---|---|
| 50 | Herpestis Gärtn. (1805) | Brami Ad. (1763) |
| 3 | Tectona L. fil. (1781) | Theka Ad. (1763) |
| 10 | Aerva Forsk. (1775) | Uretia Ad. (1763) |
| 45 | Suaeda Forsk. (1775) | Dondia Ad. (1763) |
| 90 | Myristica L. f. (1781) | Comacum Ad. (1763) |
| 30 | Isopogon R. Br. (1810) | Atylus Sal. (1807) |
| 14 | Stenocarpus R. Br. (1810) | Cybele Sal. et Kn. (1809) |
| 3 | Telopea R. Br. (1810) | Hylogyne Sal. et Kn. (1809) |
| 47 | Dryandra R. Br. (1810) | Josephia Sal. et Kn. (1809) |
| 24 | Leucospermum R. Br. (1810) | Leucadendron Sal. et Kn. (1809) |
| 60 | Persoonia Sm. (1798) | Linkia Cav. (1797) |
| 12 | Nivenia R. Br. (1810) | Paranomus Sal. et Kn. (1809) |
| 70 | Leucadendron R. Br. (1840) | Protea Sal. et Kn. (1809) |
| 3 | Knightia R. Br. (1810) | Rymandra Sal. et Kn. (1809) |
| 60 | Protea R. Br. (1810) | Gagnedi Bruce (1790) |
| 46 | Banksia L. f. (1781) | Sirmüllera O. Ktze. (cf. ap. Pimeleam) |
| 10 | Sorocephalus R. Br. (1810) | Soranthe Sal. et Kn. (1809) |
| 9 | Lomatia R. Br. (1810) | Tricondylus Sal. et Kn. (1809) |
| 76 | Pimelea Gärtn. (1788) | Banksia Forst. (1776) |
| 20 | Struthiola L. f. (1767) | Belvala Ad. (1763) |
| 12 | Exocarpus Lab. (1798) | Xylophyllos L. (1771) |
| 20 | Julocroton Mart. (1837) | Cicca Ad. (1763) |
| 175 | Pilea Lindl. (1821) | Adicea Raf. (1815) |
| 330 | Dendrobium Sw. (1799) | Callista Lour. (1790) |
| 30 | Angraecum Lindl. (1826) | Angorchis Thou. (1809) |
| 40 | Polystachya Hook. (1824-25) | Dendrorchis Thou. (1809) |
| 60 | Eulophia R. Br. (1823) | Graphorchis Thou. (1809) |
| 80 | Spiranthes Rich. (1818) | Gyrostachys Pers. (1807) |
| 400 | Pleurothallis R. Br. (1813) | Humboldtia R. et P. (1794) |
| 120 | Liparis Rich. (1818) | Leptorchis Thou. (1809) |
| 100 | Bolbophyllum Spr. (1826) | Phyllorchis Thou. (1809) |
| 85 | Eria Lindl. (1825) | Pinalia Ham. (Febr. 1825) |
| 60 | Coelogyne Lindl. (1825) | Pleione Don (Febr. 1825) |
| 8 | Libertia Spr. (1825) | Tekel Ad. (1763) |
| 19 | Patersonia R. Br. (1807) | Genosiris Lab. (1804) |
| 5 | Hosta Tratt. (1812) | Saussurea Salisb. (1807) |
| 59 | Haworthia Duv. (1824) | Catevala Ad. (1763) |
| 9 | Astelia R. Br. (1810) | Funckia W. (1808) |
| 36 | Dracaena Jurs. (1767) | Draco Ad. (1763) |
| 22 | Thysanotus R. Br. (1810) | Chlamysporum Salisb. (1809) |
| 3 | Agapanthus l'Hérit. (1788) | Tulbaghia Heist. (1753) |
| 30 | Cyanotis Don (1825) | Tonningia Neck. (1790) |
| 28 | Dichorisandra Mik. (1820) | Stickmannia Neck. (1790) |
| 40 | Luzula DC. (1805) | Juncodes Ad. (1763) |
| 60 | Chamaedorea W. (1804) | Nunnezharia R. et P. (1794) |
| 50 | Pandanus L. f. (1781) | Keura Forsk. (1775) |
| 20 | Hydrosme Schott (1858) | Corynophallus Schott (1857) |
| 215 | Paepalanthus Mart. (1833-35) | Dupatya Vell. (1825) |
| 200 | Fimbristylis Vahl (1806) | Iria Rich. (1805) |
| 33 | Rottboellia L. f. (1781) | Manisuris L. (1771) |
| 20 | Setaria Beauv. (1812) | Chamaerhaphis R. Br. (1810) |
| 3 | Phyllocladus Rich. (1826) | Podocarpus Lab. (1806) |
| 40 | Podocarpus l'Hérit. (1810) | Nageia Gärtn. (1788)" |

"In view of the International Botanical Congress to be held at Genoa, Italy, September 4th to 11th, 1892, we, the undersigned American botanists, favor the adoption of the following general principles of nomenclature:

I. The adoption of initial dates for generic and specific names.

II. That the publication of a generic name or a binominal specific name invalidates the use of the same name for any subsequently published genus or species.

III. That in the transfer of a species to a genus other than the one under which it was first published, the original specific name is to be preserved, unless such name has previously been employed in the genus to which the species is transferred; and if the author who transfers such species alters the name, it may be restored by any subsequent author.

IV. That a varietal name be treated as equal in rank to a specific name, in its relations as a homonym and in the transfer of species and varieties from one genus to another.

| | |
|---|---|
| Frederick V. Coville, | Arthur Hollick, |
| B. T. Galloway, | Elizabeth G. Britton, |
| J. M. Holzinger, | Anna Murray Vail, |
| Walter H. Evans, | Byron D. Halsted, |
| F. H. Knowlton, | Thomas C. Porter, |
| Lester F. Ward, | John K. Small, |
| George B. Sudworth, | J. Bernard Brinton, |
| N. L. Britton, | Timothy F. Allen, |
| Thomas Morong, | H. H. Rusby." |
| William E. Wheelock, | |

To the first article in both propositions there is perhaps no serious objection—if the proposers can show that such alteration of the present rule offers any adequate compensation for the disturbance it will entail.

The second and third articles of the Berlin proposition merely formulate the existing practice of most naturalists, but many would like to amend by outlawing all such names as are founded on distributed sets, *i. e.*, dating them not from such distribution, but from the appearance of a diagnosis in print.

The fourth article would be an instance of special legislation, repugnant to the sense of justice of most botanists. There are a great

many other genera in similar or even worse case, and why should these particular ones be singled out? And then, again, the name of P. Taubert signed to the articles can hardly fail to remind botanists of his recent resurrection of Aublet's generic names and inexcusable transference of all the species—of course attaching "Taub." to them; and to call attention to the fact that among the list to be conserved "in spite of the rules of priority, in order to avoid a general confusion by the change of many thousand names," those discredited by Taubert do not appear.

The second article of Dr. Britton's proposition is out of order until—at least—it shall have been adopted by zoologists in general and found to be useful in working. In botany such a rule—if made retroactive—would be of very small advantage and productive at the outset of almost infinite confusion. As a rule for present action there could be no possible exception, and a careful systematist will go farther and refrain from the giving of a generic name which has been used in zoology.

The third article is in accord with the principles and practice of most botanists, but the opponents though few are powerful. It has always seemed odd to me that if the principle of priority were admitted at all, there should ever be a question of the propriety of adhering to it in specific names, the species being the unit and generic, tribal, ordinal, etc., merely classifying names. The claim that "the oldest specific name under the proper genus" should be conserved, is little less than an absurdity—for who in these days shall say when the "proper genus" has been reached, and meantime in the irresponsible hands of Rafinesquians how many binomial synonyms may be inflicted upon us?

The fourth article is in my opinion illogical and inadmissible.

Some of the lighter and more diverting phases of our nomenclatural woes are dealt with by Prof. E. L. Greene who, in Pitt. No. 11, finds himself "minded" to take up the cudgels in behalf of Dr. Kuntze's "Revisio" and the first edition of the Systema as a starting point. In objecting to a review by Dr. Schumann he says: "Against the 1735 starting point Dr. Schumann assumes the singular and surely untenable position that the work as regards genera is a list of naked names without diagnoses." If Mr. Greene had ever seen a copy of the first edition of the Systema he would perhaps not have made the remark, which shows so well the danger of

dealing with matters not sufficiently understood. The classification of plants is in that work spread out in tabular form over two great folio pages; in these two pages there are under the mark "† Nova genera a me constituta" twenty-five genera without any mark or reference or means of diagnosis other than that afforded by "Triandra monogynia," etc., and ten times as many with no mark whatever beyond the bare word.

A second of his amusing "pronouncements" is the following: "*Watsonamra* has few if any chances of perpetuity, the genus of palms, *Serenoa*, apparently precluding it; for never yet has it been admitted that two generic names may stand in honor of the same man." We commend these remarks to our friends the mycologists in the light of, say "Saccardia," "Saccardinula," "Saccardoella," etc. Perhaps when Professor Greene and his vagaries have been forgotten some botanist, equally desirous of notoriety, may be enabled to coin a generic name or two by discovering that "Greenella" and "Greenina" are merely synonyms of "Chlora" and "Chloræa."

## A NOTE ON NOMENCLATURE.*

BY ALPHONSE DECANDOLLE.

Many botanists are alarmed by the changes in the generic names of plants proposed by Kuntze. But the researches which have been made, and the opinions which are daily published on the subject of nomenclature, may, however, give some reassurance.

I have had the curiosity to ascertain what generic names Kuntze claims should be changed in the twenty-six families which I have been studying, either for the Prodromus or the first volume of our Monographiæ, and their number is twenty-eight. Now, after an attentive consideration of the reasons given by Kuntze, only six names are found which require to be changed by the application of the well-known law of priority, while twenty-two of the changes are inadmissible.

Dr. Briquet, who is better acquainted with the family of the Labiates than any other person, has found that of the fifteen changes proposed by Kuntze, only five are justifiable, while ten are not admissible.

* Translated for Zoe from Journal of Botany, May, 1892, by C. C. P.

After these two examinations, made conscientiously, ***the number of the changes proposed by Kuntze must be reduced by two-thirds.***

While rendering, therefore, due justice to the learning and accuracy of this scientist, I am bound to say that there are several sources of error in his conclusions. I will call attention to the two most important ones:

*(a)* Kuntze takes for genera names only apparently generic, and which are not accompanied by characters sufficiently descriptive of them. A genus is only constituted by the union of a name and the distinctive characters of the plant. Without that it is a genus still-born. It is *nil*, and therefore can produce no result, especially in the application of the law of priority. All botanists are agreed about *nomina nuda* or *seminuda.*

*(b)* The starting point for the genera of Linnæus is certainly his *Genera* of 1737, and not his *Systema*, ed. 1, of 1735. This latter had only for its object to make known the twenty-four classes of the author. Some names of genera are indicated there, but without special characters, for the genus is not defined by the single notion conveyed by the term Hexandria or Pentandria digynia. It was in 1737 that Linnæus enumerated and characterized all the genera he was acquainted with, in his *Genera*, in which he abandoned the names of the *Systema*, regarding them, no doubt, as useless.

In my *Nouvelles Remarques sur la Nomenclature*, in 1883, I have explained why we should start from the *Genera* rather than from the *Systema*, and I have seen with pleasure this opinion recently sustained by Daydon Jackson (Bot. Journ. February, 1892); Botanical Gazette (March, 1892); and Schumann (Naturwiss, Rundschau, Jarhrgang 7, No. 13). The remarks of this latter scientist, favorable to our laws of nomenclature of 1867, have a value so much the greater because he says: *An understanding had been arrived at, before their publication, with the botanists of Berlin and some foreign botanists.*

The principles which I maintained in 1867 and in 1883 are thus supported by good judges, and I confess it is a great satisfaction to me in my old age.

## RECENT LITERATURE.

*Darwin and After Darwin. An Exposition of the Darwinian Theory and a Discussion of Post-Darwinian Questions.* By GEORGE JOHN ROMANES, M. A., L. L. D., F.R.S. I. The Darwinian Theory.* Ever since the publication of the Origin of Species by Means of Natural Selection, scientists have been at work adding testimony of the fact of evolution and discussing theories explanatory of the fact, until, at the present time, the literature of the subject has become highly complex and involved. It would be interesting, indeed, if the voice of Darwin could be heard to-day concerning the many questions which have arisen since his death, or upon which new light has been thrown by recent criticism and investigation. This being impossible, there is no man so pre-eminently qualified to speak for him as George J. Romanes. From personal contact and sympathy with his master, and from years of study in similar lines of investigation, he is probably more thoroughly imbued with Darwin's spirit than any other man living, and his attitude of viewing the biological problems of the day doubtless comes as near to the standpoint which Darwin himself would be expected to assume as is possible to imagine. His present work will consequently possess a double interest and value to those concerned with the literature of Darwinism.

The first volume of the series of three, the only one as yet before the public, is, as the author says in his preface, "likely to prove of more service to general readers than to professed naturalists," being "a systematic exposition of what may be termed the Darwinism of Darwin"; and yet many questions are raised, even in this first volume, in which scientists are greatly concerned. The book is very properly divided into two parts, the first being a demonstration of evolution as a fact, and the second a discussion of natural and sexual selection as more or less complete explanations of the fact. With the first part of the work naturalists are not so much concerned as the general public, for if there be any actual workers in scientific fields at the present day who are not convinced of the validity of evolution as a fact—as a description of the historical growth of organisms—there is no hope for them, and they are not worth wasting time with. With the general public, however, the case is

* Open Court Publishing Co., Chicago.

otherwise. Being unfamiliar with even a smattering of modern biological research, their attention has not been directed in these channels. Mr. Romanes, therefore, very properly considers that he has a public to convince, and argues every question from this standpoint. In criticising the first part of his book, consequently, the only thing to consider is how well and how forcibly, or, rather, from the standpoint of an outsider, how fairly he has presented the case of evolution. Had this work appeared even a comparatively short time ago there would doubtless have been many reviewers who would question the validity of his proofs, but to-day there are few who would have the temerity to openly attack such a demonstration and expose themselves to the criticism which would follow. It is really a question merely of whether his arguments are so presented and his illustrations so chosen that a person unfamiliar with the subject could reasonably be expected to follow him. And this, it seems, he has really succeeded admirably well in doing. The figured illustrations are especially worthy of notice, for both from their profuseness and the judiciousness with which they have been selected they, in many cases, speak for themselves.

After a few pages of introduction, in which the subject is discussed from a general point of view, the testimony of classification is adduced, followed in succession by that of morphology, embryology, palæontology and geographical distribution. In every case he argues with the defender of special creation and a designing deity, showing the innumerable inconsistencies and absurdities which the advocates of that view must maintain. Thus, in the chapter on geographical distribution, he shows that on islands where gales of wind are continually replenishing the mainland forms of life there are few distinct species, while on islands where high winds from the mainland do not prevail the species are, for the most part, distinct. "But," he says, "on the theory of special creation, it is impossible to understand why there should be any such correlation between the prevalence of gales and a comparative inertness of creative activity. And, as we have seen, it is equally impossible on this theory to understand why there should be a further correlation between the *degree* of peculiarity on the part of the isolated species and the *degree* in which their nearest allies on the mainland are there confined to narrow ranges, and therefore less likely to keep up any

biological communication with the islands."* The chapter on embryology is especially worthy of mention as probably the best and fullest argument for evolution ever made from this standpoint. It is noticeable that the general plan of Prof. Joseph Le Conte's work on Evolution and its Relation to Religious Thought has been followed in the first section of the work under discussion, although the illustrations and the method of presenting them are, to a large extent, unlike those of any other expounder of the subject.

I will not attempt to discuss a number of points which might be raised with regard to the second part of the book, reserving this for a future time. There is only one point which need be mentioned here. In the chapter on The Theory of Natural Selection, Mr. Romanes says:† "Next, it must be clearly understood that the life which it is the object, so to speak, of natural selection to preserve, is primarily the life of the species; not that of the individual. Natural selection preserves the life of the individual only in so far as this is conducive to that of the species. Whenever the life-interests of the individual clash with those of the species, that individual is sacrificed in favor of others who happen better to subserve the interests of the species." Why not go a step farther and say that it is the life of the genus, or the family, and not of the species, which natural selection preserves? Species or specific types count for nothing if they come into conflict with higher or better adapted specific types. The record of evolution is a history of the destruction of inferior species to make room for superior. But is it not in reality the individual, rather than the species, which natural selection preserves? I mean, of course, the best individuals. He cites as proof that natural selection works for the good of the species rather than the individual the case of the ant, "which will allow her head to be slowly drawn from her body rather than relinquish her hold upon a pupa." Let us examine this instance a little more in detail. There can be no doubt, apparently, that such an instinct as this does make for the good of the community and against the well-being of the individual concerned.

Suppose, however, this instinct of the ant which he cites had

* Pp. 230–231.

† Pp. 264-265.

not yet been developed. Then any individual ant which varied in its nature towards determination in facing an enemy would be a great benefit to the tribe, no doubt, but would it stand a better chance to survive and leave offspring who would perpetuate this tendency? On the contrary, it would be far more apt to be killed early in its career, for Mr. Romanes does not need to be reminded of the old proverb:

> "He who fights and runs away
> May live to fight another day."

If every individual who possessed this tendency towards self-sacrifice were to be killed off because, as an individual, it was less fit to survive, how could the species ever acquire this instinct? After any altruistic variation was well established it is easy to see how natural selection might favor the group of individuals possessing it, whether it be a mere isolated assemblage or an entire species, in their combined conflicts with other groups or species which did not work in harmony; but the difficulty is to understand how it could become established. The individuals would necessarily contend among themselves for superiority, and this contest would be a more immediate and vital one than the rivalry between allied species, or even different sections of the same species.

The American edition of this work is published in a very neat and attractive form. C.A.K.

*The Contemporary Evolution of Man.* By HENRY FAIRFIELD OSBORN.* In this, the first of the Cartwright Lectures for 1892, the author presents a general survey of the anatomical changes at present taking place in man, with the intention of investigating their bearing upon the question of the inheritance of acquired characters. Dr. Osborn believes that all the organs of the human body are in a state of change at the present time, although some are moving much more rapidly than others, either progressively or retrogressively. He proposes the term metatrophism for the "compensating readjustment, whereby the sum of nutrition to any region remains the same during redistribution to its parts." He considers that man is changing in structure as rapidly at the present time as the horse did in evolving from its five-toed ancestor. Variations in the skeleton, teeth and muscles are discussed in some detail. Under

* The Am. Nat. xxvi, 455-481.

the topic, The Limits of Reversion, the author calls attention to the fact that an abnormal organ or structure, even though it resembles some normal structure in a lower animal, is not necessarily a reversion, but may be a coincidence.

There is danger of forgetting the branching plan of evolution and jumping to the conclusion of a connection where none exists. In concluding, Dr. Osborn says: "There are clearly marked out several regions in the human body in which evolution is relatively most rapid, such as the lower portion of the chest, the upper cervicals, the shoulder girdle in its relation to the trunk, the lower portion of the arm and hand, the outer portion of the foot. We notice that these regions especially are centers of adaptation to new habits of life, in which new organs and new relations of parts are being acquired and old organs abandoned.

We observe, also, that all parts of the body are not equally variable, but these centers of evolution are also the chief centers of variability. The variations here are not exclusively, but mainly, of one kind; they rise from the constant struggle between adaptation and the force of heredity."

C.A.K.

*The Difficulties in the Heredity Theory.* By HENRY FAIRFIELD OSBORN.* In the second Cartwright Lecture for 1892, Dr. Osborn discusses the bearing of the facts of human evolution enunciated in his previous lecture upon the inheritance of acquired characters. The generalizations in this paper are, for the most part, re-statements of his views upon this subject, in some cases from new points of view.

The history of the heredity theory is briefly outlined, and the effect of impacts and strains upon the mammalian foot and the wearing of cusps is again alluded to. The article concludes with some brief remarks on the inheritance of mutilations, the effects of previous fertilization, and maternal impressions. The author is inclined to believe in all three, and especially declares his acceptance of the influence of maternal impressions upon the young. The note upon the inheritance of mutilations of the tails of mice is of interest, but, as the author remarks, would need confirmation.

C.A.K.

* The Am. Nat. xxvi, 537–567.

*Revision des Calanides d'eau douce* is the title of a work recently published by the well-known zoologists JULES DE GUERNE and JULES RICHARD in the Memoires de la Société Zoologique de France, vol. ii, p. 53. In this work are found described by Prof. WIL. LILLJEBORG several species from California. The work is a most excellent one, and accompanied by numerous illustrations. The following are the species from California: *Diaptonus Eiseni, D. Franciscanus, D. siciloides, D. signicauda, D. Tyrrelli, D. Tryborni, D. oregonensis, Osphranticum labronectum, Epischura nevadensis.* Prof. W. Lilljeborg is now occupied with describing a larger collection of fresh-water Copepoda and Astracoda, collected in California, and would be pleased to receive any additional specimens, in order that the account of this branch of California crustacea may be presented as fully as possible. G. E.

*A New Generic Name for the Bering Sea Fur-seal.* By T. S. PALMER. Proc. Biol. Soc. Wash. vii, 156. The genus *Callohrinus* is replaced by *Callotaria, Callirhinus* having been used in entomology and also in herpetology.

*Description of a New Prairie Dog (Cynomys mexicanus) from Mexico.* By Dr. C. HART MERRIAM. Proc. Biol. Soc. Wash. vii, 157–158. *Cynomys mexicanus* from La Ventura, Coahuila, Mex., collected by Mr. C. P. Streator.

*The Auk* for July, 1892, has a colored plate of the Rio Grande Turkey *(Meleagris gallopavo ellioti* Sennett). *A Study of the Sparrow Hawks (Subgenus Tinnunculus) of America, with Especial Reference to the Continental Species (Falco sparverius* Linn.) By EDGAR A. MEARNS. Beginning with a synopsis of the American species, the author notices the variations of plumage dependent upon age, sex and season. Descriptions are given of new subspecies: *Falco sparverius deserticolus*, Desert Sparrow Hawk, inhabiting "Southwestern United States, north to northern California and western Montana, south to Mazatlan in northwestern Mexico." *Falco sparverius peninsularis*, St. Lucas Sparrow Hawk, from Lower California. *Falco sparverius æquatorilis*, Ecuador Sparrow Hawk, from Ecuador, S. Am. Dr. Mearns's paper is based upon a study of 297 specimens, of which 241 are from North America north of Mexico. Enough phases were noticed to afford a basis for a number more subspecies, but the incipient forms have not been named.

In General Notes, Mr. R. H. Lawrence records the capture of two California jays near Vancouver, Washington, as the first record for that State. The occurrence there of the species is of interest, but was first noted by Nuttall, who met with them near Fort Vancouver.

Mr. T. S. Palmer adds four species to the list of birds of Gray's Harbor, Washington, published in the January number of the *Auk*, to which list a few dozen more additions are given by Mr. Hubbard in the present number of this journal. W. E. B.

*The Humming Birds*. By ROBERT RIDGWAY. Rep. Nat. Mus. 1890, 253–383, plates i–xlvi. To one having even the slightest inclination toward a love for birds to begin this volume is to read it through. Probably no single family of birds has received more attention from naturalists, nor admiration from all, than the humming birds, of which there are about five hundred recognized species and varieties entirely confined to the New World.

The work is virtually divided into two parts, the first treating of the general subject under divisions into topics. Early History. Names and their Origin. Geographical Distribution. Migrations. Habits. Abundance of Individuals. Actions and Attitudes. Manner of Flight. Disposition. Intelligence. Nests and Eggs, with which are given fourteen plates of illustrations, in black and white, principally after Gould. Voice. Food. Characters and Relationships, illustrated by an enlarged drawing, by Mr. Lucas, of the skeleton of *Trochilus colubris*, and by figures showing the pterylosis of a humming bird. Variations, treating of the size, bill, wing, tail, tail-coverts, are fully illustrated, there being seven plates of outlines of tails. Head Ornaments, etc. Colors of the Plumage, with nine plates illustrating fifteen species. Cause of the Changeable Hues of Humming Birds, closing with Brief Descriptions of some of the more Brilliantly Colored Kinds. Throughout the foregoing pages the technical name is mainly subordinated, and each topic is so fascinating that one wishes there were more of it, as well as of the humming bird verse which appears in appropriate places. The second part, as it may be conveniently termed, treats of the Humming Birds of the United States, illustrated by twelve plates representing thirteen species and twenty-three specimens, in black and white drawings. Subgeneric names have been used in place of

the generic names adopted by the A. O. U., and *Selasphorus floresii* in places instead of *Trochilus floresii* or *T. rubromitratus*. Analyses of species and full descriptions are given, as also a "key to the genera of humming bird occurring in the United States, Mexico, Cuba and the Bahamas," adapted from the author's "Manual of North American Birds." Opinions will differ regarding placing Anna's humming bird as the most beautiful of North American hummers; in California the popular vote would be cast for an adult male Allen's or rufous humming bird, excepting, of course, the straggler Floresi's humming bird. W.E.B.

*Outlines of Zoology*. By J. ARTHUR THOMSON, M.A., F.R.S.E. In this volume Prof. Thomson has presented the students of zoology with a very valuable general guide. It is essentially a book for beginners rather than for more advanced students, the ground covered being so extensive that no great attention to minute details is possible. The work is especially adapted to the requirements of the novice, from the fact that it is written in a very fascinating style and is clear and, for the most part, simple without any sacrifice of scientific accuracy. Nearly a hundred pages of introduction deal with questions of general and fundamental scientific interest—classification, physiology, cells and tissues, reproduction, heredity, geographical distribution, paleontology and evolution. This section is admirable for the terseness with which the ground is covered. As might be expected, the author lays some stress upon his own peculiar views with regard to metabolism, reproduction, etc., although these are in no wise unnecessarily obtruded. A noticeable innovation with regard to his classification is the inclusion of Balanoglossus and Cephalodiscus among the vertebrates. In giving his reasons for so doing he says that in these two forms "the vertebrate affinities are well marked, and we shall at least emphasize the fact that there are no hard and fast lines of division if we place these two types at the beginning of the chordate series."

The body of the work is occupied with a short account of each class in the animal series. After a table showing the general classification of a group is given a "survey of types," under such topics as general life, general structure, minute structures (forms of cells, etc.), reproductive organs and development. The structure of each group is represented by a rather rough but clear diagram.

A systematic classification giving the distinctive features of each class and order follows, the account closing with a few general remarks on the life and history of the group in question. Although dealing primarily with anatomy, the external form, habits and general classification of animals are by no means slighted. C.A.K.

*Journal of Morphology*, VI, 1–360. Vertebrate Cephalogenesis. II. A Contribution to the Morphology of the Vertebrate Ear, with a Reconsideration of its Functions. By HOWARD AYERS. In this work a lengthy and exceedingly important investigation of the embryology, morphology and physiology of the cordate ear is presented. The author has made an exhaustive examination of a great number of representative types, and. as a result, revolutionizes many of the generally accepted ideas, both of the development structure and functions of many of the parts of the ear. The work is illustrated with twelve plates and a number of diagrams and figures. Mr. Ayers concludes from his investigations that the vertebrate ear is not related phylogenetically to the invertebrate, but is formed by the union of two sense organs—the superficial canal complex. He finds a close connection between the ear of the alligator and of mammals, and considers that the organ of Corti of the latter is a direct descendent of the organ of Corti in the former. This modifies the position of birds in the scale, so far as the morphology of the ear is concerned. The author says: "Having found, from my own investigations, in three groups of birds — Rasores (Gallus), Columbinæ (Columba), and Passeres (Mimus)—that the development of the cochlea is not so far advanced as in the hydrosaurian reptilia, it will be necessary to change the view advocated by Hasse, according to which the saurian reptilia stand as transitional forms between the amphibia and the lower reptilia and the birds, for it is obvious that in cochlear anatomy the birds hold a place apart from the direct line of descent as typified in the mammalian cochlea." *

Mr. Ayers' generalizations with regard to the development of the ear are of great importance. "Although *ontogenetic* evidence," he says, † "seems to lead to the conclusion that the auditory organ arose by the invagination of a *single superficial sense organ*, it is by no means certain that this is true, for there are certain facts of comparative anatomy and certain phylogenetic considerations which

* P. 227. † P. 231.

point to the conclusion that the auditory organ has arisen by the bringing together of two originally distinct sense organs which were together sunk below the surface." He then gives the evidence for this, which is mainly the distinct origin of the nerve roots which supply the ear. He accordingly considers the membranous labyrinth as a vestigial structure, and prophecies that in the future ear little will be left save the cochlea. Among the points in morphology which he has discovered the following are of general interest: the hair-bearing cells of the cochlea are probably never double, as was formerly supposed; the sense organs on the floor of the cochlea consist of a series of linear fibres closely united together, and are not a single band-like sensory apparatus, as described by previous investigators; the basilar membrane does not possess sufficient elasticity "to serve for the transmission of the delicate undulations which it has been supposed to transmit, and from its composition a great deal of the motion imparted to it would necessarily be lost in transmission;" "the evidence of comparative anatomy is entirely against the existence of the spiral nerve bands;" "the ear is supplied by two distinct nerves which have widely different origins in the brain, and are, in reality, *branches from two nerves*, and so not a discrete cranial nerve, as has formerly been supposed to be the case;" "the so called membrana tectoria of previous authors is, in reality, a hair-band or field of long, slender hairs which spring from the tops of the hair cells and form a waving plume on the crest of the ridge of the organ of Corti;" "the membrana tectoria, the membrana reticularis, Loewenberg's net, and the three or four main trunks of the system of spiral nerves of the cochlea have no existence as such in the living mammalian ear."

The physiological results of Mr. Ayers' investigations are of equal importance with the morphological. He details experiments conclusively proving that the semicircular canals are not indispensable for the equilibration of an animal, which function he very reasonably considers to be exercised by all the nerves of sense in general. He may, however, be a trifle hasty in assuming that the semicircular canals are without any function whatever. He considers "the outer and middle ear to be mere accessory structures acquired by the higher vertebrates in ever-increasing complexity, for the sole purpose of enabling the animal to preserve in the aërial ocean, on or near the bottom of which they live, the necessary

aquatic conditions in which they were born (phylogenetically), and which they must preserve or lose their auditory organ completely." He believes that the cochlear organs alone are enabled to perceive all kinds of sound. The sound waves institute a responsive vibration in all or nearly all the filaments, in succession, of the hair-band of the organ of Corti, according to Mr. Ayers. "Timbre, or the tonal color of sounds, is due to a combination of the stimuli or the effects of the excitation of a series of vibrations of which the main or fundamental tone is most prominent, while the other vibrational impulses make themselves felt as 'coloring' of this base. The combination is a psychical phenomenon, and there is no combined result of simultaneous sympathetic vibrations transmitted from the ear; on the contrary, each vibrational impulse is transmitted to the brain at its full value, and its effect in audition is due entirely to psychical processes." C.A.K.

*Psyche*, February, 1892, contains a contribution on the "Blood-tissue" of the insecta by WILLIAM M. WHEELER, continued in the March and April numbers. The papers give evidence of very careful and thorough work in a comparatively unworked field.

C.A.K.

*The Nature of the Shoulder Girdle and Clavicular Arch in Sauropterygia.* By H. G. SEELEY. Proc. Roy. Soc. LI, pp. 119–151. A comprehensive investigation of the clavicular arch in Plesiosauridæ and Elasmosauridæ, with a scheme of classification for the two groups. In discussing the classification, the author cites facts illustrative of Cope's law of parallelism. He says: "And it is remarkable that many Liassic species have the articular faces of the vertebral centra deeply biconcave, while in many Cretaceous species those surfaces are nearly or quite flat; in the shoulder girdle nothing but continued ossification, apparently, is needed to convert the Liassic Plesiosaurian into the Oolitic and Cretaceous Elasmosaurian type. *Eretmosaurus* is the nearest approach to this type known from the Lias.

It thus appears as though some animals complete their embryology early in life, others at intervals during life, while in most types the embryonic development takes place gradually during successive epochs of geological time, giving rise to classification of its stages, indicated as genera, families, orders; and, therefore, that the young individuals of a late period of time simulate genera of an earlier age." C.A.K.

## PROCEEDINGS OF SOCIETIES.

California Academy of Sciences. *May 2, 1892.* President Harkness in the chair.

The Librarian reported 185 additions to the library.

Dr. H. H. Behr read a paper on the Flight of Insects.

Dr. Harkness exhibited gall-wasps just hatched from leaf-bud galls of the oak.

*June 6, 1892.* President Harkness in the chair.

Accessions of fossil and recent shells were reported from Mrs. M. Burton Williamson, Miss McVenn, W. J. Raymond, T. S. Brandegee, Dr. C. L. Anderson, Dr. Dozier, F. Engles, Henry Hemphill, Gustav Eisen, R. Reid, Dr. S. Bowers.

Two hundred and ninety additions to the library were reported.

The President announced the death of J. J. Rey, L. L. Robinson and S. M. Wilson, life members, and of Prof. E. Regel, honorary member.

Dr. Gustav Eisen made a preliminary report on the expedition to Lower California.

*June 20, 1892.* President Harkness in the chair.

Dr. Gustav Eisen read a paper on the Lost Civilization of the Mayas as Indicated by Archæological Remains in Mexico and Central America, illustrated by stereopticon views.

*July 18, 1892.* President Harkness in the chair.

The Librarian reported 440 additions to the library.

Mr. S. W. Holladay read a paper on Earthquake Freaks.

Charles A. Keeler gave an account of his recent trip to the Farallon Islands, and exhibited a portion of the collections made on the trip.

California Botanical Club. *May 16, 1892.* President Campbell in the chair.

The following were elected to membership: Mrs. Austin Sperry, Adolph Sutro, E. J. Molera, Miss Louise Bundschu, F. N. Noteslein, Mrs. M. A. Wills, Miss Clara Rice, Mrs. C. E. Miller, Mrs. F. Butler, Mrs. Edward Probert, Theodor Holm, Alfred J. McClatchie.

Prof. D. H. Campbell delivered a lecture on Ferns and their Relations, explaining their affinities as shown by the later researches into their structure, and the details of their reproduction as com-

pared with that of their allies. The audience were enabled to inspect specimens of most of the plants under consideration.

*July 11, 1892.* Mrs. Brandegee in the chair.

The following were elected to membership: A. W. Robinson, Mrs. M. E. P. Ames, Miss Aphra Rogers, Miss Mae F. Dority, Robert L. Toplitz, Mrs. R. L. Toplitz, Mrs. E. J. Corbett, H. S. Durden.

CALIFORNIA ZOOLOGICAL CLUB. During April and May the California Zoological Club, under the auspices of the California Academy of Sciences, gave a course of popular lectures on zoology, illustrated with stereopticon views. The lectures were delivered by Charles A. Keeler, as follows: 1. Creation of Law—a popular exposition of the doctrine of evolution, April 21. 2. Fundamental Groups of Animals—an explanation of the principles of classification and illustrations of the leading types in zoology, April 28. 3. The Mammalia—illustrated by about 80 views of representative species, May 5. 4. The Mammals of California—illustrated with stereopticon views and prepared specimens, May 12. 5. The Bird, May 19. 6. Song Birds of California, May 26.

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# BALANOGLOSSUS AS ONE OF THE GENERALIZED TYPES IN ZOOLOGY.*

With Plate xxii.

BY WILLIAM E. RITTER.

During the summer of 1890, it was my good fortune to be able to spend the vacation studying in Alexander Agassiz's Marine Laboratory at Newport, R. I. While there I became greatly interested in Balanoglossus and its larva, and collected considerable material for its study, and the original drawings here presented were made at that time.

I take this opportunity to call the attention of our Pacific Coast zoologists to this remarkable animal more particularly than the zoological text-books and the special papers treating of it would be likely to do, the desire being to hasten the bringing of the creature to light if it exist on these shores. At the same time, however, I will add a few observations and reflections of my own, that may not be altogether without interest to those who have made a detailed study of the animal. Since Kowalevski[1] published the results of his investigations on the development of the simple Ascidians in 1866, and there pointed out their relationship to the Vertebrates, no animal has been brought into court that has given such weighty testimony against the reality of a definite and hard fixed line separating Vertebrates from Invertebrates, such as was supposed by the older zoologists, as has this same wormlike Balanoglossus.

The credit of having first recognized the true nature of the animal

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* Modified from a paper read before the California Zoological Club, San Francisco, March 26, 1892.

[1]A. Kowalevski, Entwickelungsgeschichte der einfachen Ascidien. Mém. Acad. Imp. Sci., St. P., viie sér. T. x, No. 15, 1866.

belongs to Mr. William Bateson,[2] a young English morphologist, who studied the structure and development of an American species found on our Atlantic coast; though it is an interesting fact that the distinguished Russian already mentioned was the first to study in detail the structure of the adult, he having published the results of his investigations on this subject in the same year that his classical Ascidian paper, mentioned above, appeared.

We will give a short account of the structure, development, and habits of the animal, and also consider briefly its claims to the right of being raised from the ranks of the "lowly worm" to a place among the nobler Chordata, which promotion was proposed by Mr. Bateson, and has been adopted by several more recent writers.

By the aid of Figs. 1 and 2 we may be able to get a fairly good idea of the appearance and anatomy of the adult animal. The original figure, here copied from Korschelt & Heider,[3] was made by Alexander Agassiz and represents the Atlantic coast species, *B. Kowalevskii.* The creature is divided into three very distinct regions: the proboscis, *pro.*; the collar, *col.*, and the abdomen, *abd.*, which is again composed of a pharyngeal or respiratory portion, and an abdomen proper or digestive portion. The proboscis is a firm muscular organ, cylindrical or somewhat conical in shape, but varying considerably both in form and length in different species; in most species it is, however, proportionally shorter than in the one here represented. The proboscis is joined to the collar by a short peduncle. In its normal condition the collar is nearly cylindrical in shape, and, as with the proboscis, there is nothing either in form, surface marking, or color, to readily distinguish the dorsal from the ventral side. The mouth is ventrally situated, but its position at the anterior end of the collar at the point of attachment of the peduncle to this latter is so effectually shut in by a sort of rim-like projection on the anterior edge of the collar that it is scarcely visible, particularly when the parts are in a state of contraction.

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[2] Wm. Bateson. The Early Stages in the Development of Balanoglossus (sp. incert). Quart. Journ. Micro. Sci., Vol. xxiv, Apr., 1884. Also: Continued Account of the Later Stages in the Development of Balanoglossus Kowalevskii, and of the Morphology of the Enteropneusta, ibid Vol. xxvi, p. 511, 1886. Also: The Ancestry of the Chordata, ibid Vol. xxvi, p. 535, 1886.

[3] E. Korschelt und K. Heider, Lehrbuch der vergleichenden Entwicklungsgeschichte der wirbellosen Thiere, erstes Heft, Jena, 1890.

The abdomen is several times longer than the other two parts combined and is very distensible. It is soft and frail and one rarely sees it whole, so easily does it break as the animal is being extracted from its tube in the soft mud or sand in which it lives.

The surface of this region is much less regular than that of the other two parts previously described, it being, particularly in its anterior, pharnygeal portion, somewhat quadrilateral with irregular transverse folds affecting particularly the dorsal angles. As seen by the figure the gills, *gi.*, are arranged in a double series on the dorsal side of the animal, each series, as seen from the surface, being composed of a large number of crescentic openings.

The sexual orifices are also found in this region, but are very minute, *s. or.* The three portions of the animal differ from one another in color. The proboscis is a uniform very light yellow, the collar is also yellow but of a considerably more pronounced shade. The abdomen is of a brownish tint marked with darker spots, and for a portion of its length has a greenish shade from the presence of the liver within showing through the body wall. In size the creature may reach a length of eight inches in some of the larger species. It will be noticed from this description that the animal is entirely without paired appendages, either for locomotion, prehension, or sensation. Its only organ of movement is its proboscis.

The animal is entirely marine, so far as known, and is confined to shallow water near shore, and as already said, lives buried in mud or sand. The species found on the New England coast can be collected at low tide only, when the earth in which it lives is uncovered. It is usually found about a foot or two below the surface, and one readily determines where to dig for it by the very characteristic spirally coiled cast of sand and mud at the opening of its tube that has been ejected by the animal within.

As it is in the creature's role as a candidate for a place among the chordata that it has become chiefly distinguished in recent years, the attention that we here give to its anatomy may profitably be from the standpoint of a comparison with the fundamental chordate structure. In this way the points of agreement may be brought out with emphasis, and at the same time the points of disagreement may be made equally emphatic.

Bateson, who, as already said, was the first to carry out this comparison in detail, points out three primary and four secondary par-

ticulars in which its structure and development resemble the typical chordate. These are as follows: Of the first class, (1) the position and origin of the central nervous system; (2) the possession of a notochord; (3) the possession, method of origin and arrangement of gill-slits. Of the second class, (1) the origin of the mesoblast—the middle germ layer; (2) the asymmetry of the anterior parts; (3) the opercular fold; (4) the excretory funnels opening into the atrial cavity. It must serve our present purpose to consider the three primary features here enumerated; the secondary ones must be passed by with some general statements, merely.

All vertebrates are characterized by the possession, at least in embryonic life, of a notochord arising from the dorsal portion of the primitive digestive tract, and extending parallel with the long axis of the animal; by the possession of a cerebro-spinal nerve axis that arises from the ectoderm of the dorsal portion of the embryo, and extends parallel with the notochord along its dorsal side; by the possession of paired respiratory organs that arise from the anterior portion of the digestive tube and communicate with the external world, either through the mouth or independently of it; and by the possession of a large median dorsal blood vessel situated between the digestive tract and the notochord, in which the blood flow from before backward.

To all these fundamental features Balanoglossus certainly presents some remarkable resemblances. The nerve cord arises from the dorsal portion of the ectoderm of the embryo by a process that is quite similar to that by which the same structure arises in many of the fishes, as the lamprey and the bony fishes. However, certain important differences must not be disregarded.

In all vertebrates the posterior end of the medullary plate—the nerve cord in its early stage—terminates at the blastopore, while in Balanoglossus, it does not extend so far back; in fact the portion of it that seems most nearly to resemble the vertebrate cord is apparently confined to the collar, while the anus is situated at the extreme posterior end of the animal. Furthermore it seems quite doubtful if the canal, or space that finally appears in the cord of Balanoglossus, is in any sense morphologically comparable to the vertebrate neural canal.

Again, it is to be observed that in all vertebrates, even including Amphioxus, the nerve cord is encased in a connective-tissue or

cartilaginous sheath, which is directly continous with a corresponding sheath surrounding the notochord, while in Balanoglossus no such sheath is found, the nerve cord and notochord not only not being in close relation, but the dorsal blood vessel is situated between them. However, so far as the absence of the sheath is concerned, the difficulty is hardly a weighty one since we must suppose, both from developmental evidence and on *a priori* grounds, that the earliest vertebrate ancestors were without such a sheath. But the situation of the dorsal blood vessel as described is not so easily explained away, though Dr. Morgan[4] has suggested that the dorsal aorta of vertebrates is another vessel entirely. His suggestion would seem to imply that in vertebrates the dorsal aorta has arisen since the vertebrate phylum branched off from the common ancestral form, and that the dorsal vessel corresponding to the one now found in Balanoglossus has disappeared. This conjecture may receive support from the fact that the heart of Balanoglossus is situated in the proboscis, and hence cannot certainly have any relation to the vertebrate heart.

In this connection it seems to me worth while to refer to the lymph canals described by Lankester[5] within the notochordal sheath, one on the dorsal side and one on the ventral side, in Amphioxus. And the same author speaks of the great difficulty in distinguishing blood vessels from lymph vessels in this animal. It would be rash to maintain a homology between the lymph canal in the dorsal portion of the Amphioxus notochord and the dorsal blood vessel of Balanoglossus, yet no harm can come from a cautious suggestion of such a possibility.

The notochord of Balanoglossus originates from the dorsal wall of the digestive tube as it does in vertebrates, and in later stages of development resembles the vertebrate notochord in its histological structure considerably, thus satisfying two of the important criteria of homologous structures. But, in all vertebrates, without exception, the notochord arises from nearly or quite the entire length of the embryonic digestive tube, while in Balanoglossus it arises as an evagination from near the anterior end and grows out anteriorly

[4] T. H. Morgan. Growth and Metamorphosis of Tornaria, Journ. of Morphology, Vol. v, p. 407, 1892.

[5] E. Ray Lankester. Contributions to the knowledge of Amphioxus lanceolatus, Yarrell, Quart. Journ. Micro. Sci., Vol. xxix, p. 365, 1889.

in the form of a pouch extending through the peduncle somewhat into the base of the proboscis. Its connection with the digestive tube never becomes severed as it does in all vertebrates.

It appears to me that it is in the "branchial basket" and the parts immediately associated with it that we find the most convincing evidence of genetic relationship between Balanoglossus and vertebrates. In this particular greater similarity exists between Balanoglossus and Amphioxus, than between the Cyclostome fishes and higher fishes. And the resemblance is the more convincing because of the complexity of structure—the large number of points presented for comparison in the two cases. A detailed description and comparison of all these points is quite out of the question in the present connection. I may mention some of them, however, and refer those who may desire to examine the subject more carefully to the papers of Agassiz,[6] Spengel,[7] Bateson,[8] Lankester,[9] Morgan,[10] Willey,[11] and others. These are: the method of origin of the primary gill slits in the two cases, and the way in which these are each divided into two in later life by the so-called tongue bars; the very large and somewhat variable number of gill slits, as compared with all vertebrates, and the fact that the number increases till a late period in the developmental history of the animal; the similarity of the chitinoid bars that serve as a framework for the gill slits in the two cases; the beginning, so to speak, in Balanoglossus, of what would correspond, both in origin and in morphological relations, were the development carried further, to the atrium of Amphioxus; and finally, but by no means least in possible significance, the collar funnels in Balanoglossus comparable to the atrio-cœlomic funnels in Amphioxus. These latter structures

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[6] Alexander Agassiz. The History of Balanoglossus and Tornaria. Mem. Amer. Acad. Arts and Sci., Vol. ix, 1867.

[7] J. W. Spengel. Ueber den Bau und der Entwicklung des Balanoglossus. Amtl. Ber. der 50 Vers. deutsche Naturf. u. Aertze in München, 1877.

Also: Zur Anatomie des Balanoglossus. Mittheil. aus der Zool. Stat. Neapel, Bd. v, 1884.

[8] l. c.

[9] l. c.

[10] l. c.

[11] Arthur Willey. Later Larval Development of Amphioxus, Quart. Journ. Mic. Sci., Vol. xxxii, 1892.

are probably in no wise connected, functionally, with the branchial apparatus (certainly not in Balanoglossus); but since structurally they are, and since we have no sure knowledge of what their function is, we may well enumerate them along with the structures in immediate connection with the branchial apparatus.

Now, having spoken briefly of the parts in the organization of Balanoglossus that do present strong resemblances to the corresponding parts in Amphioxus, we must turn our attention to those which do not.

The proboscis, which is so characteristic of the animal, not only cannot be compared with any structure in vertebrates, but the organs which it contains, viz.: the "proboscis gland," the heart, and the pore by which its cavity communicates with the exterior, are wholly unrepresented in any vertebrate. Likewise none of the portions of the abdomen lying behind the gill region can hardly be compared with anything found in vertebrates.

The structure of the body walls in the two animals is totally different. In Balanoglossus it is derived largely from the ectoderm, the muscular portion derived from the mesoderm being comparatively weak and small, showing nothing of the muscle plates so well developed in Amphioxus. Still it must be admitted that this conspicuous difference is rather secondary than fundamental since the origin of the mesoblastic pouches presents considerable resemblance in the two cases.

On the whole, then, it seems to me that by a careful weighing of all the evidence now at hand we are compelled to place this animal in our classification nearer the vertebrates than to any other group of animals (its comparison in several points with a remarkable creature brought from the depths of the ocean by the Challenger dredgings appears to be well founded. Unfortunately, however, all our knowledge of this animal rests upon the adult structure of a single species only and of a few individuals, even, of this one).

Strongly beliving in the affinities of the larva of Balanoglossus with the Echinoderm larva, Metschnikoff,[12] in 1881, attempted to follow out the logical consequences of this belief and to reduce the structure of the adult Echinoderm and Balanoglossus to a common fundamental type. The basal feature for this comparison is the

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[12] E. Metschnikoff. Ueber die systematische Stellung von Balanoglossus, Zool. Anz., Bd. iv, 1881.

water system in the two groups, the proboscis of Balanoglossus being supposed to represent a single ambulacral tentacle of an Echinoderm. This is certainly a most ingenious speculation and one that must be admitted to be not wholly without plausibility, especially as regards this particular structure. The resemblance in other points of structure is very obscure, and it should be remembered that similarity between groups in several fundamental points of structure increases the probability of homology between these structures—and so of genetic relationship between the animals possessing them—many times beyond the number of points of resemblance. For example, we can see no *a priori* reason, either physiological or morphological, why a water system should not exist in correlation with several styles of animal organization. Consequently, when we find an animal possessing it that in other respects resembles other animals that possess it very obscurely if at all, the probability that the system is homologous in the two instances is not very great, it seems to me; at any rate there is great room for the possibility of analogy merely, i. e., that the structure has had an independent origin in the two cases. When, however, there is an essential agreement in several points of organization, as we have seen to be the case between Balanoglossus and vertebrates, the probabilities of mere analogy or independent origin are many times less.

Developmentally Balanoglossus presents some most interesting chapters in phyologenitic history—interesting both on account of the parts of them that we can understand, and of those that we cannot, as yet satisfactorily interpret. One of the most strikingly interesting things in this history is that the different species do not tell the same story, that they do not all present the same pedigree, and this is true, notwithstanding the fact that they are all so closely related that no one has ever pretended to claim more than specific differences between them.

So far as is known all the species excepting one pass through a very distinct and quite prolonged larval stage. This one—an American form — develops without any larval stage. The larva was discovered by the distinguished German zoologist, Johannes Müller,[18] in 1848. He was at this time studying the em-

[18] Johannes Müller. Ueber die Larven und die Metamorphose der Echinodermen, Zweite Abhandlung, Abhandl. d. Akad. d. Wiss. zu Berlin, Juli, 1848.

bryology of Echinoderms, and among the larvæ of the various groups of these animals that he collected with his tow net in the Mediterranean Sea was this which he named Tornaria from the fact that it constantly rotates about its long axis as it progresses through the water. He thought it was probably the larva of some Echinoderm and finally, after studying as many stages as he was ever able to find, decided it to be a Holothurian. Afterward several zoologists collected and described the same larva and were deceived as its original discoverer had been till finally, in 1869, Metschnikoff,[14] a Russian zoologist, was fortunate enough to see the Tornaria so far transformed into the Balanoglossus as to be able to recognize its true nature. The adult Balanoglossus had been well known for a long time. But although it was now soon established beyond a doubt that Tornaria is the larva of Balanoglossus and not of an Echinoderm its close resemblance to the larva of the latter, particularly to Auricularia, the larva of the Holothurian, was recognized by all who studied it. And I may here add that the advance of knowledge of both the Echinoderm larva and of Tornaria, even to the present moment, has only served to increase the belief in the minds of many morphologists that there is an actual genetic relationship between the two forms.

Figures 4, 5, 6 and 7 represent the Tornaria in several stages of its development. Figure 7 represents as early a stage as has ever been seen, the larvæ having always been captured after they have escaped from the egg and betaken themselves to their free swimming life. They are very transparent and at this stage very small, the specimen here figured being between .2 and .3 of a millimeter in length—barely large enough to be visible to the unaided eye, excepting it be accustomed to seeking such objects. From its extreme transparency the internal organs can be easily seen in the living animal.

On the surface are several thickened bands bearing cilia. In the smallest larvæ the course of these bands is comparatively simple, as is shown in Fig. 7, *c. b.* Were the opposite side of the larva to be seen, two more bands would be found in corresponding positions.

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[14] E. Metschnikoff. Untersuchungen über die Metamorphose einiger Seethiere. 1. Ueber Tornaria. Zeitschr. f. Wiss. Zool., Bd. xx, 1870.

The four all unite at the apex of the anterior end of the larva, *a. p.;* and since the two short ones are continuous at their other ends by a cross-band in front of the mouth as are also the two longer ones by a similar band behind the mouth, the whole four form in reality a single band at this stage. At a little older stage these bands become much more complicated by being separated at the apex, and by taking on several loops in their course. The details of this need not be entered into, but a general idea of it can be gathered from Fig. 6, *c. b.* Moreover, an entirely new band appears, also ciliated, the cilia here being considerably longer than those of the other bands. This one passes around the anal end of the larva in the form of a girdle, and this form it never changes as long as it exists, viz.: throughout the larval life, Figs. 5 and 6, *c. c. b.* At the apex of the larva, at the point to which the longitudinal bands converge, is found a thickened spot in the ectoderm, supposed to be nervous; and in the center of this is a pair of pigmented eye-spots, *a. p.* and *e. s.* of the figures.

At the stage represented by Fig. 7, the only internal organs are the digestive tube consisting of an œsophagus, *œ.*, a stomach, *s.*, and a short intestine, *i.*, the mouth being placed at *m.*, and the anus at *a*, at the posterior end of the body; and the very small beginning of the "water vascular system," as it was originally called from its supposed identity with that organ in the Echinoderm larva. This is a single sac placed on the dorsal surface of the œsophagus, probably, however, not connected with it, even at this early stage. Its cavity communicates with the exterior by a tube, *c. t.*, the pore of which is on the dorsal side of the larva slightly to the left of the median line, *d. p.* A thread-like muscle band passes down from the apical plate to the sac *mu.*

Without attempting to follow the steps of development, we may pass to the condition that is presented by a larva just previous to its transformation into the Balanoglossus. Such a stage is shown by Fig. 4. The new organs that have appeared in addition to those already described are the so-called proboscis glands, *p. b.*, the mesoblastic pouches, *m. p.* [Fig. 5], the heart, *h.*, and three pairs of gills, *g.* The exact origin of the proboscis gland—or vesicle as it is sometimes called—is not known, neither is its function known, though in the adult animal it is thought by some to be an excretory organ, while others have called it an accessory gill.

The mesoblastic pouches have arisen as two paired evaginations from the lateral walls of the digestive tract. These four pouches become entirely severed from their original connection, and form large thin walled, entirely closed bags. They become so large in fact that each pair almost entirely surrounds the digestive tube, their inner walls being in contact with this latter while their outer walls are in contact with the inner surface of the ectoderm. In short, they form the real body cavity, or cœlom. The heart is a peculiar structure. It is said to arise as a space, merely, between the water vesicle and the proboscis gland. The walls of these two latter organs become closely pressed against each other, the contact being interrupted in a small area only, and this is the heart which becomes filled with a fluid in which there are no cellular elements. This makes the walls of the heart to consist of parts of the walls of two other organs, and this means that if each of these has a function of its own the tissue of the heart has a triple office, viz.: the portion forming a part of the wall of the water vesicle functions in that capacity; the portion belonging to the proboscis gland performs its office there, and finally the two parts together perform the functions of a heart. The organ can be very distinctly seen in the living larva when placed on its side and flattened down somewhat with a compressor (Fig. 4 is drawn from such a preparation). The walls are very distinct, and the contractions constant and regular. It should be pointed out, however, that the contractions are of quite a different character from what is seen in the hearts of most other animals. It does not consist either in a uniform, simultaneous contraction of the entire wall, as one sees take place, for instance, in the spherical vascular organs on the sides of certain marine leeches; or of a wave of contraction passing from one end to the other, the contraction affecting the entire circumference at each successive point passed over by the wave, as takes place in peristaltic movement, or as is seen in the heart of Ascidians, for example. But one-half of the wall does not contract at all, while in the other half a sharp fold sink deep into the cavity of the organ and travels across it, the edge of the fold not extending across, however, to the opposite wall.

The gills have arisen as paired pouches from the dorsal wall of the œsophagus, the anterior pair appearing first and the others in succession behind them. They do not fuse with the ectoderm and

break through to communicate with the outside world as in the adult animal, till a later period, after the metamorphosis has begun. While these new organs have been developing the old ones have been increasing in size and form. The water vesicle has elongated lengthwise of the animal; its walls have thickened in some regions, and as seen in Fig. 4, at X, a pair of horn-like processes now extend downward and a little backward, straddling the œsophagus. I would call particular attention to these because they have been seen and figured by Fewkes,[15] but their existence has been denied by Morgan.[16]

The changes that take place during the metamorphosis can here be touched upon only in the briefest way. The Tornaria loses its transparency, largely; gives up its free swimming career and settles down to the bottom of the vessel in which it is contained; its cilia disappear, and with them the thickened bands on which they are situated; the whole larva elongates, the anterior portion to become the proboscis, and the region behind the circular band of cilia to become the abdomen. The gills, which in the Tornaria are far forward, are brought to the position in which they are found in the adult, viz.: behind the collar, by the drawing backward of the stomach and œsophagus during the transformation. Figure 3 represents a young Balanoglossus about as far advanced as has yet been obtained by keeping them in confinement. The transformation to this stage takes place quite rapidly when once it sets in, but beyond this it seems to proceed very slowly. In fact, in the artificial conditions of the aquarium the little animal seems determined not to develop much further.

As already said, in the species the development of which was studied by Mr. Bateson, there is no Tornaria stage. It is in this species only that the method of cleavage and formation of the blastula and gastrula are known. In these early stages the processes are very similar to those which take place in Amphioxus and the Tunicates.

The very interesting question at once arises—it being remembered that the adults of all species are so nearly alike as to have never

[15] J. W. Fewkes. On the Development of Certain Worm Larvæ. Bull. Mus. Comp. Zool., Harvard University, Vol. xi, 1883.

[16] l. c.

raised a doubt that all belong to one genus—which is the more primitive way of development, directly without the larval stage, or through the larva? Did the first Balanoglossus reach its developmental goal by the long, indirect tornaria road, and did a more modern one, imbued with the rapid transit idea, cut across lots leaving the ancient roundabout way? Or did the older forms go across while the younger ones have taken to the longer road? No one has discussed this question at any length, and I am not going to undertake it at present. In fact without a knowledge of the first stages of development of the Tornaria, it would probably be impossible to arrive at any very satisfactory conclusion on the subject. It is suggested by Korschelt & Heider[17] that the direct development is the more primitive, their reason for this conclusion being found in the fact that the mouth and anus do not form in this larva till a comparatively late stage—a condition which would seem to be incompatible with a free swimming of larva.

There are, however, some quite serious difficulties in the way of this suggestion, one of which is that the circumanal ciliated band appears very early in the directly developing species, while it forms quite late in the Tornaria.

For the solution of this question, as well as of several others, it is of the utmost importance that we fill up the gap that now exists in our knowledge of the earliest embryonic stages of Tornaria; and to this end the more species we have access to, the better become our chances of being able to do this. It is quite probable that somewhere on our great extent of sand and mud beach a representative of the genus will be found.

EXPLANATION OF THE FIGURES OF PLATE XXII.

Fig. 1. Balanoglossus kowalevskii. (After A. Agassiz, from Korschelt and Heider.)

Fig. 2. Sagittal longitudinal section through the proboscis and collar of Balanoglossus sarniensis. (After Köhler, from Korschelt and Heider.)

Fig. 3. The young Balanoglossus, shortly after its transformation; under the compressor.

Fig. 4. The anterior portions of a Tornaria shortly before its transformation to Balanoglossus. The larva was flattened down somewhat by the compressor. The outlines drawn with a camera lucida.

Fig. 5. A Tornaria at a somewhat older stage than Fig. 6, to show internal structures.

[17] l. c.

Fig. 6. The youngest stage of Tornaria yet seen. Actual size between .2 mm. and .3 mm.

Fig. 7. Surface view of Tornaria considerably older than the one shown in the following figure, to show the tortuous course of the ciliary bands.

Figures 3, 4, 5, 6 and 7 were all drawn by the writer from the living animals, at Newport, R. I., 1890.

ABBREVIATIONS USED IN THE FIGURES.

| | | | |
|---|---|---|---|
| *a.* | Anus. | *h.* | Heart. |
| *abd.* | Abdomen. | *i.* | Intestine. |
| *a.p.* | Apical plate. | *m.* | Mouth. |
| *c. b.* | Ciliated band. | *mu.* | Muscle band. |
| *ch.* | Notochord. | *m. p.* | Mesoblastic pouches. |
| *col.* | Collar. | *n.* | Nerve cord. |
| *c. t.* | Tube of water system. | *œ.* | Œsophagus. |
| *d. b.* | Dorsal blood vessel. | *pro.* | Proboscis. |
| *d.p* | Dorsal pore. | *p. b.* | Proboscis gland. |
| *e. s.* | Eye spot. | *s. or.* | Sexual orifices. |
| *g.* | Gills. | *v. b.* | Ventral blood vessel. |

## RELICS FROM AN INDIAN BURYING GROUND.

BY L. BELDING.

On the north bank of the Stockton Slough on land of Mr. Edward F. Jones is an extensive Indian burying ground where hundreds, if not thousands, of Indians have been buried, and where I have, during the last fourteen or fifteen years, found some very interesting relics, but none of them interested me as much as those which were made of the adobe soil of the neighborhood, and which appear to me to be unique. The burying ground is in an extensive stoneless tract and substitutes for stones were made from the convenient soil, apparently by wetting, shaping with the hand, marking, and then baking in fire. These artificial stones were usually nearly round and would weigh about a half-pound each, but there was a considerable variety in size, form and marking; the latter of which was probably indicative of family or individual ownership, and the stones were probably used for cooking food, but they may have had some connection with the burial customs of these Indians.

Among other things found here were two perforated discs which resemble a form described by Mr. Bowers and Paul Schumake, and which Mr. Henshaw refers to as weights to digging sticks.

These two were made of the same material and in the same manner as the artificial stones and were too frail to be used in the way Mr. Henshaw mentions in "Perforated Stones from California," Bureau of Ethnology, 1887.

A stone digging tool was found which was chisel-shaped at one end, was about sixteen inches long and about two inches in diameter. It must have been very useful in digging the Tule potato *(Sagittaria)* which is now sometimes called "China potato," which grew and still grows in abundance along the sloughs and in the extensive tule marshes of the vicinity.

The obsidian spear and arrow-heads found here were fine examples of aboriginal skill. Two obsidian crescent-shaped knives or implements, which had probably been used in dressing fish, had their convex edges squarely notched or blocked. They are or were on exhibition in the Smithsonian building in 1882, and differ from anything I have seen elsewhere.

The burial ground appears to have once been the site of an Indian village, as bones of elk, deer, fish, ducks, geese, and other birds are plentiful. A circular, saucer-shaped excavation for a fandango or sweathouse, is additional evidence that a village once occupied the spot. Many of the skeletons which appear to have been buried last, and about the same time, were probably victims of small-pox or some other epidemic.

Waves from passing steamboats have washed away a considerable part of the ground, and a large levee has recently been built on and of the mound.

## RECENT ADDITIONS TO THE NORTH AMERICAN LAND MAMMAL FAUNA.

BY WALTER E. BRYANT.

For several years I have been keeping a list of the new species of North American mammals as the descriptions appeared, with notes on the changes of nomenclature, for convenience of reference. Since 1884, when Mr. True published "A Provisional List of the Mammals of North and Central America, and the West Indian Islands" (Proc. U. S. Nat. Mus. 1884, Appendix), I believe nothing has appeared in that line. Certainly the nomenclature of the class is in need of revision, and I am informed that an authority has in preparation some work of the kind.

Nothing is attempted in the present article but to give the names, authority, citation of publication and habitat as far as known, except in a few instances when changes have been made in order to bring the names more into conformity to the latest authorities. The species here enumerated are mainly or entirely additions to Mr. True's list, the general order of which has been followed. Considerable shuffling of names has been done in the literature upon the subject during the past few years, necessitated by the acquired knowledge concerning the earlier writers and the species treated of by them and not resulting from the whims of authors or the disregard to generally accepted principles of nomenclature. A few of these changes are noticed here when they concern a given species.

The writings of Allen, Merriam and Mearns have supplied the greater portion of the present compilation, which it is hoped will be useful to workers in mammalogy, especially to those whose growing interest in this class of animals may result in the future in the organization of a union such as has done so much for the ornithology of North America.

The majority of the additions here given as will be seen were described in—

| | | | | | | |
|---|---|---|---|---|---|---|
| North American Fauna, | No. | 1, | issued | October | 25, | 1889. |
| " " " | " | 2, | " | October | 30, | 1889. |
| " " " | " | 3, | " | September | 11, | 1890. |
| " " " | " | 4, | " | October | 8, | 1890. |
| " " " | " | 5, | " | July | 30, | 1891. |

Bulletin of the American Museum of Natural History, vol. ii, 1887–90; vol. iii, 1890–91; vol. iv, in press.

Under North America I have included the species described from the country recognized by the American Ornithologists' Union.

To Mr. T. S. Palmer, First Assistant of the Division of Ornithology and Mammalogy of the U. S. Department of Agriculture, I am greatly indebted for substantial aid in the preparation of this paper. He has kindly read the proof sheets and supplied most of the added generic names with data and about fifteen of the added species and noted several important eliminations in the list.

Mr. Palmer has also made some changes in the spelling of geographical names, in which he has followed the rulings of the U. S. Board on Geographic Names. When a single definite locality is

given it is the type locality and not necessarily the entire habitat of the species.

While the appended list of eliminated species is by no means complete, it is given for whatever assistance it may be to students.

GENERIC AND SUBGENERIC ADDITIONS AND CHANGES.

1. APLODONTIA Richardson. [Andetates *Haplodon*] Richardson.

(Cf. Merriam, Science, vii, March 5, 1886, p. 219; Ann. N. Y. Acad. Sci. iii, May, 1886, p. 312.)

2. PHENACOMYS Merriam.

Merriam, N. Am. Fauna, No. 2, Oct. 30, 1889, p. 28.

Type, *Phenacomys intermedius* Merriam, from Kamloops, British Columbia.

3. SITOMYS Fitzinger. [*Hesperomys* Waterhouse, antedates *Vesperimus* Coues.]

Fitzinger, Sitzungsber, math. nat. classe, K, Acad. Wiss. Wien, lvi, 1867, p. 97.

Type *Cricetus myoides* Gapper, from Lake Simcoe, Ontario, Canada.

(Cf. Merriam, Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 27, foot-note.)

4. ONYCHOMYS Baird. [Subgenus.]

Baird, Mamm. N. Am. 1857, p. 458. Raised to generic rank by Merriam N. Am. Fauna, No. 2, p. 3.

Type, *Hypudæus leucogaster* Max Wied from old Fort Clark, North Dakota.

5. REITHRODONTOMYS Giglioli. [Antedates *Ochetodon* Coues, 1874.]

Giglioli, Richerche intorno alla Distribuzione Geografica Generale, Roma, 1873, p. 160, foot-note.

(Cf. Merriam, Proc. Biol. Soc. Wash, vii, Apr. 13, 1892, p. 26, foot-note.)

6. CHÆTODIPUS Merriam. [Subgenus of *Perognathus.*]

Merriam, N. Am. Fauna, No. 1, p. 5.

Type, *Chætodipus spinatus* Merriam, from lower Colorado River, California.

7. PERODIPUS Fitzinger. [Antedates *Dipodops* Merriam, 1890.]

Fitzinger, Sitzungsber. math. nat. Classe, K. Akad. Wiss. Wien, lvi, 1867, p. 126.

Type, *Dipodomys agilis* Gambel, from Los Angeles, California.

(Cf. Merriam, Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 26, foot-note).

8. MICRODIPODOPS Merriam.

Merriam, N. Am. Fauna, No. 5, July 30, 1891, p. 115.

Type, *Microdipodops megacephalus* Merriam, from Halleck, Nevada.

9. EUDERMA H. Allen.

Allen, Proc. Acad. Nat. Sci. Phila. Jan. 1892, p. 467.

Type, *Histiotus maculatus* J. A. Allen, from Los Angeles County, California.

10. OTOPTERUS Lydekker.

Flower & Lydekker, Mammals Living and Extinct, London, 1891, p. 673, foot-note.

Replaces *Macrotus* Gray which is preoccupied.

11. NOTIOSOREX Baird MS.

Coues, Bull. U. S. Geol. Surv. Terr. iii, May 15, 1877, p. 646. (Subgenus.)

Type, *Sorex (Notiosorex) crawfordi*, from Fort Bliss, Doña Ana County, New Mexico.

(Cf. Flower & Lydekker, Mam. Living and Extinct, 1891, p. 624, raised to generic rank.)

12. BASSARISCUS Coues.

Science ix, May 27, 1887, 516.

Replaces *Bassaris* Wagler which is preoccupied.

13. LATAX Gloger.

Nova Acta Acad. Cæs. Leop. Car. xiii, pt. ii, 1827, p. 511.

Revived by Stejneger to replace *Enhydra* Fleming which is preoccupied. (Cf. Stejneger, Naturen, 1885, p. 172.)

14. SPILOGALE Gray.

Proc. Zool. Soc. London, 1865, p. 150.

Revived by Merriam, N. Am. Fauna No. 4, p. 1.

Type, *Mephitis interrupta* Rafinesque.

15. LUTREOLA Wagner. [Subgenus.]

Suppl. Schreb, Saügth. ii, 1841, 241.

Used as genus by Merriam, Ann. Rep. Dept. Agriculture, 1887, (1888), p. 433.

In a paper entitled "The Geographic Distribution of Life in North America with special reference to the Mammalia," by C. Hart Merriam, M. D. (Proc. Biol. Soc. Wash. vii, April 13, 1892, pp. 1-64), the following subgenera are revived or used for the first time:

*Teonoma* Gray (bushy tailed wood-rats).
*Neosorex* Baird (genus of shrews reduced to subgenus).
*Atophyrax* Merriam (genus of shrews reduced to subgenus).
*Tamiasciurus* Trouessart (containing the chickarees).
*Neosciurus* Trouessart (subgenus of *Sciurus*).
*Parasciurus* Trouessart (subgenus of *Sciurus*.)
*Xerospermophilus* (type, *Spermophilus mohavensis*).
*Ammospermophilus* (type, *Spermophilus leucurus*).
*Neofiber* True (reduced to subgenus of *Arvicola*).

SPECIFIC AND SUBSPECIFIC ADDITIONS AND CHANGES.

1. DIDELPHIS VIRGINIANA CALIFORNICA (Bennett) Allen. Texas Opossum.
*Didelphys californica* Bennett, Pr. Zool. Soc. i, 1833, 40.
Texas to City of Mexico.

2. CARIACUS MACROTIS CALIFORNICUS (Caton). Southern Mule Deer.
*Cervus macrotis* var. *californicus* Caton., Am. Nat. x, Aug. 1876, p. 464.
Southern California.

3. ARCTOMYS DACOTA Merr. Black Hills Marmot.
Merriam, N. Am. Fauna, No. 2, p. 8.
Black Hills, Dakota.

4. CYNOMYS ARIZONENSIS Mearns.
Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 305.
Southern Arizona.

5. CYNOMYS GUNNISONI Baird. Short-tailed Prairie Dog.
Revived by Merriam, N. Am. Fauna, No. 3, p. 58.
Arizona; Colorado.

6. CYNOMYS LEUCURUS Merr.
Merriam, *ibid*, No. 4, p. 33.
Fort Bridger, Wyoming.

7. TAMIAS STRIATUS LYSTERI Rich.
Cf. Merriam, Am. Nat. xx, 1886, p. 242.

Mountains of Pennsylvania; Adirondack region of New York; northern New England; eastern Canada north to the Gulf of St. Lawrence, and in the interior north to James's Bay, Hudson's Bay.

8. TAMIAS STRIATUS GRISEUS Mearns.

Mearns, Bull. Am. Mus. Nat. Hist. iii, 2, p. 231.

Upper Mississippi Valley west of the Great Lakes.

9. TAMIAS CASTANURUS Merr.

Merriam, N. Am. Fauna, No. 4, p. 19.

Wahsatch Mountains, Utah.

10. TAMIAS CHRYSODEIRUS Merr.

Merriam, *ibid*, p. 19.

Fort Klamath, Oregon, and southward in the Sierra Nevada.

11. TAMIAS CINERASCENS Merr. Gray Ground Squirrel.

Merriam, *ibid*, p. 20.

Helena, Montana; Idaho.

12. TAMIAS MACROHABDOTES Merr. Long-eared Chipmunk.

Merriam, Proc. Biol. Soc. Wash. iii, Jan. 27, 1886, 25.

Sierra Nevada Mountains, Placer County, California.

13. TAMIAS OBSCURUS Townsend, MS. Lower California Chipmunk.

Allen, Bull. Am. Mus. Nat. Hist. iii, 1, June, 1890, 70.

San Pedro Martir Mountain, Lower California.

14. TAMIAS TOWNSENDII HINDSII (Gray). Redwood Chipmunk.

Revived by Allen in Bull. Am. Mus. Nat. Hist. iii, 1, 75.

Coast region of California, from San Francisco northward. Restricted to the narrow coast belt west of the Coast Range.

15. TAMIAS QUADRIMACULATUS Gray. Sacramento Chipmunk.

Gray, Ann. & Mag. Nat. Hist. 3d ser. xx, 1867, p. 435.

Revived by Allen, *ibid*, p. 80.

Valley of the Sacramento River, California, north to Shasta County, California, and Fort Klamath, Oregon.

16. TAMIAS SENEX Allen.

Allen, *ibid*, p. 83.

Sierra Nevada Mountains, Placer County, California, north to Fort Klamath, Oregon.

17. TAMIAS MERRIAMI Allen.

Allen, *ibid*, p. 84.

Mountains of Southern California, from San Diego County north to Tulare and Monterey counties.

18. TAMIAS SPECIOSUS Merriam, MS. San Bernardino Chipmunk.

Allen, *ibid*, p. 86.

San Bernardino Mountains, California.

19. TAMIAS FRATER Allen. Sierra Nevada Chipmunk.

Allen, *ibid*, p. 88.

Sierra Nevada Mountains, Placer County, California.

20. TAMIAS AMŒNUS Allen. Klamath Chipmunk.

Allen, *ibid*, p. 90.

Fort Klamath, Oregon, and southward to Placer County, California, Idaho.

21. TAMIAS CINEREICOLLIS Allen. Arizona Chipmunk.

Allen, *ibid*, p. 94.

San Francisco Mountain and neighboring mountains of Central Arizona.

22. TAMIAS UMBRINUS Allen. Uinta Chipmunk.

Allen, *ibid*, p. 96.

Mountains of Northern and Central Utah (Wahsatch and Uinta Ranges.)

23. TAMIAS QUADRIVITTATUS GRACILIS Allen. San Pedro Chipmunk.

Allen, *ibid*, p. 99.

Socorro County, New Mexico, and Apache County, Arizona.

24. TAMIAS QUADRIVITTATUS LUTEIVENTRIS Allen. Buff-bellied Chipmunk.

Allen, *ibid*, p. 101.

Main chain of the Rocky Mountains in Montana, from Helena northward, probably into British America.

25. TAMIAS QUADRIVITTATUS AFFINIS Allen. Columbian Chipmunk.

Allen, *ibid*, p. 103.

Interior of British Columbia, east of the Cascade Mountains.

26. TAMIAS QUADRIVITTATUS NEGLECTUS Allen. Lake Superior Chipmunk.

Allen, *ibid*, p. 106.

Northeastern Minnesota, Northern Wisconsin, northern peninsula of Michigan, and northern shore of Lake Superior.

27. TAMIAS MINIMUS Bach. Pale Chipmunk.

Revived by Allen, *ibid*, p. 110.

"Bad lands" and plains of Dakota, Montana, and Wyoming.

28. TAMIAS MINIMUS CONSOBRINUS Allen. Wahsatch Chipmunk.

Allen, *ibid*, p. 112.

Eastern border of the Great 'Basin (Eastern Utah, Western and Southern Colorado, and Northwestern New Mexico).

29. TAMIAS MINIMUS PICTUS Allen. Desert Chipmunk.

Allen, *ibid*, p. 115.

The Great Basin, from western border of Great Salt Lake westward, and from Southern Utah and Southern Nevada to the Snake Plains of Eastern Washington.

30. SPERMOPHILUS LEUCURUS Merr. Antelope Squirrel.

*Tamias leucurus* Merriam, N. Am. Fauna, No. 2, p. 20.

Southern Utah, northern Arizona, southern Nevada, southern California, and the peninsula of Lower California.

31. SPERMOPHILUS LEUCURUS CINNAMOMEUS Merr. White-tailed Chipmunk.

*Tamias leucurus cinnamomeus* Merriam, *ibid*, No. 3, p. 51.

Grand Cañon of the Colorado and Painted Desert, Arizona.

32. SPERMOPHILUS INTERPRES Merr.

*Tamias interpres* Merriam, *ibid*, No. 4, p. 21.

El Paso, Texas.

33. SPERMOPHILUS GRAMMURUS ATRICAPILLUS Bryant. Black-capped Ground Squirrel.

Bryant, Proc. Cal. Acad. Sci. 2d ser. ii, p. 26.

Peninsula of Lower California, from latitude 25° northward in mountainous region.

34. SPERMOPHILUS BELDINGI Merr. Sierra Nevada Spermophile.

Merriam, Ann. N. Y. Acad. Sci., iv, Dec. 28, 1888, p. 317.

Sierra Nevada Mountains, California.

35. SPERMOPHILUS ARMATUS Kennicott. Mountain Spermophile.

Revived by Merriam, N. Am. Fauna, No. 5, p. 38.

Uinta Mountains, Utah, to Blackfoot Mountains, Idaho.

36. SPERMOPHILUS ELEGANS Kennicott. Kennicott's Spermophile.

Revived by Merriam, *ibid*, p. 39.

Fort Bridger, Wyoming and northwestward to Lemhi Valley, Idaho.

37. SPERMOPHILUS COLUMBIANUS (Ord). Burrowing Squirrel.

*Arctomys columbianus* Ord, "Guthrie's Geog. 2d Am. Ed., ii, 1815, 292–303."

Revived by Merriam, *ibid*, p. 39.

Idaho.

38. SPERMOPHILUS MOHAVENSIS Merr. Mohave Desert Spermophile.

Merriam, *ibid*, No. 2, p. 15.

Mohave Desert, California.

39. SPERMOPHILUS NEGLECTUS Merr.

Merriam, *ibid*, p. 17.

Dolan Spring, Arizona.

40. SPERMOPHILUS SPILOSOMA PRATENSIS Merr.

Merriam, *ibid*, No. 3, p. 55.

San Francisco Mountain, Arizona.

41. SPERMOPHILUS SPILOSOMA OBSIDIANUS Merr. Dusky Spotted Spermophile.

Merriam, *ibid*, p. 56.

San Francisco Mountain, Arizona.

42. SPERMOPHILUS CRYPTOSPILOTUS Merr. Desert Spermophile.

Merriam, *ibid*, p. 57.

Painted Desert, Arizona.

43. SPERMOPHILUS CANESCENS Merr.

Merriam, *ibid.*, No. 4, p. 38.

Cochise County, Arizona.

44. SPERMOPHILUS SPILOSOMA MACROSPILOTUS Merr.

Merriam, *ibid*, p. 38.

Pinal County, Arizona.

45. SPERMOPHILUS SPILOSOMA MAJOR Merr.

Merriam, *ibid*, p. 39.

Albuquerque, New Mexico.

46. SCIURUS FREMONTI MOGOLLONENSIS Mearns. Mogollon Chickaree.

*Sciurus hudsonius mogollonensis* Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 277.

47. SCIURUS HUDSONIUS VANCOUVERENSIS Allen. Vancouver Chickaree.

Allen, *ibid*, iii, 1, Nov. 14, 1890, p. 165.

Vancouver Island.

48. SCIURUS HUDSONIUS CALIFORNICUS Allen. California Chickaree.

Allen, *ibid*, p. 165.

Sierra Nevada Mountains, Placer County, California.

49. SCIURUS CAROLINENSIS HYPOPHÆUS Merr.

Merriam, Science, vii, No. 167, April 16, 1886, p. 351.

Minnesota.

50. SCIURUS FOSSOR NIGRIPES Bryant. Black-footed Gray Squirrel.

Bryant, Proc. Cal. Acad. Sci. 2d ser. ii, p. 25.

Coast region of California, southward from San Francisco.

51. SCIUROPTERUS VOLANS SABRINUS (Shaw). Hudsonian Flying Squirrel.

*Sciurus sabrinus* Shaw, Gen. Zoology, Mammalia, ii, pt. 1, 1801, 157.

Revived by Merriam in N. Am. Fauna, No. 5, p. 51.

Idaho.

52. APLODONTIA MAJOR Merr.

Merriam, Science, vii, Mar. 5, 1886, p. 219; Ann. N. Y. Acad. Sci. iii, 10, May, 1886, p. 312.

California.

53. FIBER ZIBETHICUS PALLIDUS Mearns. Pale Muskrat.

Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 280.

Arizona.

54. EVOTOMYS CAROLINENSIS Merr.

Merriam, Am. Journ. Sci. xxxvi, Dec. 1888, p. 460.

Mountains of North Carolina.

55. EVOTOMYS GALEI Merr. Gale's Red-backed Mouse.

Merriam, N. Am. Fauna, No. 4, p. 23.

Boulder County, Colorado.

56. EVOTOMYS OCCIDENTALIS Merr. Western Red-backed Mouse.
Merriam, *ibid*, p. 25.
Chehalis County, Washington.

57. EVOTOMYS CALIFORNICUS Merr. California Red-backed Mouse.
Merriam, *ibid*, p. 26.
Humboldt County, California.

58. EVOTOMYS IDAHOENSIS Merr. Idaho Red-backed Mouse.
Merriam, *ibid*, No. 5, p. 66.
Idaho.

59. EVOTOMYS GAPPERI BREVICAUDUS Merr.
Merriam, *ibid*, p. 119.
Black Hills, South Dakota.

60. EVOTOMYS DAWSONI Merr. Dawson's Red-backed Mouse.
Merriam, Am. Nat. xxii, July, 1888, 649.
Finlayson River, Northwest Territory.

61. PHENACOMYS INTERMEDIUS Merr.
Merriam, N. Am. Fauna, No. 2, p. 32.
Kamloops, British Columbia.

62. PHENACOMYS CELATUS Merr.
Merriam, *ibid*, p. 33.
Godbout, P. Q., Canada.

63. PHENACOMYS LATIMANUS Merr.
Merriam, *ibid*, p. 34.
Fort Chimo, Ungava, Hudson Bay Territory.

64. PHENACOMYS UNGAVA Merr.
Merriam, *ibid*, p. 35.
Fort Chimo, Ungava, Hudson Bay Territory.

65. PHENACOMYS LONGICAUDUS True.
True, Proc. U. S. Nat. Mus. xiii, 826, Nov. 15, 1890, p. 303.
Marshfield, Coos County, Oregon

66. PHENACOMYS OROPHILUS Merr. Mountain Lemming Mouse.
Merriam, N. Am. Fauna, No. 5, p. 65.
Idaho.

67. ARVICOLA DRUMMONDII Aud. & Bach.
Audubon & Bachman, N. Am. Quad. iii, 1854, 166.

Revived by Merriam, Proc. Biol. Soc. Wash. vii, Apr. 13, 1892, p, 25.

Rocky Mountains, Western Alberta.

68. ARVICOLA MOGOLLONENSIS Mearns. Mogollon Mountain Vole.

Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 283.

Mogollon Mountains, Central Arizona.

69. ARVICOLA (MYNOMES) ALTICOLUS Merr. Mountain Vole.

Merriam, N. Am. Fauna, No. 3, p. 67.

San Francisco Mountain, Arizona.

70. ARVICOLA (MYNOMES) MACROPUS Merr. Big-footed Arvicola.

Merriam, *ibid*, No. 5, p. 59.

Salmon River, Saw Tooth and Pahsimeroi Mountains, Idaho.

71. ARVICOLA (MYNOMES) MORDAX Merr. Cantankerous Arvicola.

Merriam, *ibid*, p. 61.

Idaho.

72. ARVICOLA (MYNOMES) NANUS Merr. Dwarf Arvicola.

Merriam, *ibid*, p. 62.

Idaho.

73. ARVICOLA (MYNOMES) LONGICAUDUS Merr. Long-tailed Arvicola.

Merriam, Am. Nat. xxii, Oct. 1888, 934.

Black Hills, South Dakota.

74. ARVICOLA AUSTERUS MINOR Merr. Northern Prairie Meadow Mouse.

Merriam, Am. Nat. xxii, July, 1888, 598.

Turtle Mountain, North Dakota.

75. ARVICOLA PALLIDUS Merr.

Merriam, Am. Nat. xxii, August, 1888, 702.

Fort Buford, North Dakota.

76. ARVICOLA PAUPERRIMUS Cooper. Pallid Lemming Mouse.

Revived by Merriam, *ibid*, p. 64.

Idaho, Washington, Nevada. (?)

77. SITOMYS TRUEI (Shufeldt).

*Hesperomys truei* Shufeldt, Proc. U. S. Nat. Museum, viii, Sept. 14, 1885, p. 403.

Fort Wingate, New Mexico.

78. SITOMYS ANTHONYI (Merr.)

*Hesperomys (Vesperimus) anthonyi* Merriam, Proc. Biol. Soc. Wash. iv, April 15, 1887, 5.

Grant County, New Mexico.

79. SITOMYS FLORIDANUS (Chapman).

*Hesperomys floridanus* Chapman, Bull. Am. Mus. Nat. Hist. ii, 3, 117.

Gainesville, Florida.

80. SITOMYS NIVEIVENTRIS (Chapman).

*Hesperomys niveiventris* Chapman, *ibid*, p. 117.

Florida.

81. SITOMYS AMERICANUS ARCTICUS Mearns. Arctic Deer Mouse.

*Hesperomys leucopus arcticus* Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 285.

Hudson Bay Territory.

82. SITOMYS AMERICANUS NEBRACENSIS (Baird). Black-eared Deer Mouse.

*Hesperomys leucopus nebracensis* (Baird) Mearns, *ibid*, p. 285.

Montana; northwestern part of Indian Territory.

83. SITOMYS AMERICANUS TEXANUS (Woodhouse). Texan Deer Mouse.

*Hesperomys leucopus texanus* (Woodhouse) Mearns, *ibid*, p. 285

Northwestern Texas; Indian Territory.

84. SITOMYS MEGALOTIS (Merr.) Leaf-eared Cliff Mouse.

*Hesperomys megalotis* Merriam, N. A. Fauna, No. 3, p. 63.

Grand Cañon of the Colorado and Desert of the Little Colorado, Arizona.

85. SITOMYS AMERICANUS RUFINUS (Merr.) White-footed Mouse.

*Hesperomys leucopus rufinus* Merriam, *ibid*, p. 65.

San Francisco Mountain, Arizona.

86. SITOMYS FRATERCULUS (Miller).

*Vesperimus fraterculus* Miller, Am. Nat. xxvi, March, 1892, 261.

Dulzura, San Diego County, California.

87. SITOMYS BOYLII (Baird.)

*Hesperomys boylii* Baird, Proc. Acad. Nat. Sci. Phila. 1855, 335.

Revived by Merriam, Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 32.

Middle Fork of the American River, California.

88. SITOMYS MACROPUS Merr.

Merriam, Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 34.

*Hesperomys macropus* Merriam, N. Am. Fauna, No. 4, p. 53.

Lake Worth, Florida.

89. SITOMYS NASUTUS (Allen).

*Vesperimus nasutus* Allen, Bull. Am. Mus. Nat. Hist. iii, 2, June 30, 1891, p. 299.

Larimer County, Colorado.

90. SITOMYS MEARNSII (Allen).

*Vesperimus mearnsii* Allen, *ibid*, p. 300.

Brownsville, Texas; Fort Verde, Arizona.

91. SITOMYS CRINITUS (Merr.) Cañon Mouse.

*Hesperomys crinitus* Merriam, N. Am. Fauna, No. 5, p. 53.

Snake River, Idaho.

92. SITOMYS TAYLORI (Thomas).

*Hesperomys (Vesperimus) taylori* Thomas, Ann. & Mag. Nat. Hist. 5th ser. xix, 1887, p. 66.

San Diego, Duval County, Texas.

93. ORYZOMYS AQUATICUS Allen.

Allen, Bull. Am. Mus. Nat. Hist. iii, 2, June 30, 1891, p. 289.

Brownsville, Texas.

94. ONYCHOMYS LONGIPES Merr. Texas Grasshopper Mouse.

Merriam, N. Am. Fauna, No. 2, p. 1.

Concho County, Texas.

95. ONYCHOMYS LONGICAUDUS Merr. Long-tailed Grasshopper Mouse.

Merriam, *ibid*, p. 2.

St. George, Utah.

96. ONYCHOMYS MELANOPHRYS Merr. Black-eyed Grasshopper Mouse.

Merriam, *ibid*, p. 2.

Kanab, Utah.

97. ONYCHOMYS MELANOPHRYS PALLESCENS Merr. Desert Scorpion Mouse.

Merriam, *ibid*, No. 3, p. 61.

Apache County, Arizona.

98. ONYCHOMYS LEUCOGASTER BREVICAUDUS Merr. Idaho Grasshopper Mouse.

Merriam, *ibid*, No. 5, p. 52.

Idaho.

99. ONYCHOMYS FULIGINOSUS Merr. Dusky Scorpion Mouse.

Merriam, *ibid*, No. 3, p. 59.

Between San Francisco Mountain and Desert of the Little Colorado, Arizona.

100. SIGMODON HISPIDUS LITTORALIS Chapman.

Chapman, Bull. Am. Mus. Nat. Hist. ii, 3, p. 118.

"Probably confined to the coasts of Southern Florida."

101. SIGMODON HISPIDUS ARIZONÆ Mearns. Arizona Cotton Rat.

Mearns, *ibid*, ii, 4, p. 287.

Fort Verde, Arizona.

102. SIGMODON HISPIDUS TEXIANUS (Aud. & Bach.)

*Arvicola texiana* Aud. & Bach. Quad. N. Am. iii, 1853, p. 229.

Revived by Allen, *ibid*, iii, 2, June 30, 1891, p. 287.

Texas.

103. NEOTOMA CINEREA OCCIDENTALIS (Baird). Dusky Wood Rat.

Revived by Allen, *ibid*, p. 287.

Idaho; Shoalwater Bay, Washington.

104. NEOTOMA CINEREA DRUMMONDII (Richardson).

*Myoxus drummondii* Richardson, Zool. Journ. iii, 1828, 517.

Revived by Merriam, Proc. Biol. Soc. Wash. 7, April 13, 1892, p. 25.

Rocky Mountains, British Columbia.

105. NEOTOMA BRYANTI Merr. Bryant's Wood Rat.

Merriam, Am. Nat. xxi, Feb. 1887, p. 191.

Cerros Island, Lower California.

106. NEOTOMA MICROPUS Baird. Texan Wood Rat.

Revived by Allen, Bull. Am. Mus. Nat. Hist. iii, 2, June 30, 1891, p. 282.

San Fernando River, Tamaulipas, Mexico, northward to Brownsville, Texas.

107. NEOTOMA MICROPUS CANESCENS Allen. Pallid Wood Rat.

Allen, *ibid*, p. 285.

Oklahoma Territory.

108. THOMOMYS PERPALLIDUS Merr. Desert Pocket Gopher.
*Thomomys talpoides perpallidus* Merriam, Science viii, 203, Dec. 24, 1886, p. 588.
Colorado Desert, California; Painted Desert, Arizona.

109. THOMOMYS CLUSIUS FUSCŪS Merr. Mountain Pocket Gopher.
Merriam, N. Am. Fauna, No. 5, p. 69.
Idaho, in mountains.

110. THOMOMYS FULVUS (Woodhouse).
*Geomys fulvus* Woodhouse, Proc. Acad. Nat. Sci. Phila. vi, 1852, 201.
Revived by Merriam, N. Am. Fauna, No. 3, p. 71.
San Francisco Mountain, Arizona.

111. GEOMYS PERSONATUS True.
True, Proc. U. S. Nat. Mus. xi, Jan. 5, 1889, p. 159.
Padre Island, Texas.

112. GEOMYS BURSARIUS LUTESCENS Merr.
Merriam, N. Am. Fauna, No. 4, p. 51.
Lincoln County, Nebraska.

113. PEROGNATHUS FASCIATUS FLAVESCENS Merr.
Merriam, N. Am. Fauna, No. 1, p. 11.
Kennedy, Nebraska.

114. PEROGNATHUS BIMACULATUS Merr.
Merriam, *ibid*, p. 12.
Fort Whipple, Arizona.

115. PEROGNATHUS LONGIMEMBRIS (Coues).
Merriam, *ibid*, p. 13.
Fort Tejon; San Bernardino, California.

116. PEROGNATHUS APACHE Merr.
Merriam, *ibid*, p. 14.
Apache County, Arizona.

117. PEROGNATHUS INORNATUS Merr.
Merriam, *ibid*, p. 15.
Fresno County, California.

118. PEROGNATHUS OLIVACEUS Merr.
Merriam, *ibid*, p. 15.
Kelton, Utah.

119. PEROGNATHUS OLIVACEUS AMŒNUS Merr.
Merriam, *ibid*, p. 16.
Nephi, Utah.

120. PEROGNATHUS FORMOSUS Merr.
Merriam, *ibid*, p. 17.
St. George, Utah.

121. PEROGNATHUS INTERMEDIUS Merr.
Merriam, *ibid*, p. 18.
Mud Spring, Arizona.

122. PEROGNATHUS FALLAX Merr.
Merriam, *ibid*, p. 19.
San Bernardino, California.

123. PEROGNATHUS OBSCURUS.
Merriam, *ibid*, p. 20.
Camp Apache, Grant County, New Mexico.

124. PEROGNATHUS SPINATUS Merr.
Merriam, *ibid*, p. 21.
Lower Colorado River, California.

125. PEROGNATHUS PARADOXUS Merr.
Merriam, *ibid*, p. 24.
Trego County, Kansas.

126. PEROGNATHUS PARADOXUS SPILOTUS Merr.
Merriam, *ibid*, p. 25.
Gainesville, Cook County, Texas.

127. PEROGNATHUS CALIFORNICUS Merr.
Merriam, *ibid*, p. 26.
Berkeley, California.

128. PEROGNATHUS ARMATUS Merr.
Merriam, *ibid*, p. 27.
Mount Diablo, California.

129. PEROGNATHUS LORDI (Gray).
Merriam, *ibid*, p. 28.
British Columbia.

130. PEROGNATHUS MOLLIPILOSUS Coues.
Merriam, *ibid*, p. 29.
Fort Crook, California.

131. PEROGNATHUS FULIGINOSUS Merr. Dusky Pocket Mouse.

Merriam, *ibid*, No. 3, p. 74.
San Francisco Mountain, Arizona.

132. PEROGNATHUS FEMORALIS Allen.
Allen, Bull. Am. Mus. Nat. Hist. iii, 2, June 30, 1891, p. 281.
Dulzura, San Diego County, California.

133. PEROGNATHUS MERRIAMI Allen.
Allen, *ibid*, iv, 1, March 25, 1892, p. 45.
Southeastern Texas.

134. DIPODOMYS DESERTI Stephens.
Stephens, Am. Nat. xxi, Jan. 1887, p. 42, pl. v.
Mohave and Colorado Desert regions of southeastern California.

135. DIPODOMYS MERRIAMI Mearns.
Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 290.
New River, Arizona.

136. DIPODOMYS AMBIGUUS Merr.
Merriam, N. Am. Fauna, No. 4, p. 42.
El Paso, Texas.

137. DIPODOMYS SPECTABILIS Merr.
Merriam, *ibid*, p. 46.
Dos Cabezos, Cochise County, Arizona.

138. DIPODOMYS CALIFORNICUS Merr.
Merriam, *ibid*, p. 49.
Mendocino County, California.

139. PERODIPUS COMPACTUS (True).
*Dipodomys compactus* True, Proc. U. S. Nat. Mus. xi, Jan. 5, 1889, p. 160.
Padre Island, Texas.

140. PERODIPUS CHAPMANI (Mearns).
*Dipodomys chapmani* Mearns, *ibid*, p. 291.
Fort Verde, Arizona.

141. PERODIPUS LONGIPES Merr.
*Dipodops longipes* Merriam, N. Am. Fauna, No. 3, p. 71.
Painted Desert, Arizona.

142. PERODIPUS SENNETTI (Allen).
*Dipodops sennetti* Allen, Bull. Am. Mus. Nat. Hist. iii, 2, April 29, 1891, p. 226.
Near Brownsville, Cameron County, Texas.

143. PERODIPUS RICHARDSONI Allen.
Allen, Bull. Am. Mus. Nat. Hist. iii, 2. June 30, 1891, p. 277.
"Northern Texas to southern Wyoming and westward to the Rocky Mountains."

144. MICRODIPODOPS MEGACEPHALUS Merr.
Merriam, N. Am. Fauna, No. 5, p. 115.
Halleck, Nevada.

145. ZAPUS INSIGNIS Miller.
Miller, Am. Nat. xxv, Aug. 1891, p. 742.
Nova Scotia and New Brunswick.

146. LAGOMYS SCHISTICEPS Merr.
Merriam, N. Am. Fauna, No. 2, p. 11.
Sierra Nevada Mountains, California.

147. LEPUS CINERASCENS Allen.
Allen, Bull. Am. Mus. Nat. Hist. iii, 1, Oct. 1890, p. 159.
Los Angeles County, California.

148. LEPUS SYLVATICUS FLORIDANUS Allen.
Allen, *ibid*, p. 160.
Brevard County, Florida.

149. LEPUS IDAHOENSIS Merr. Idaho Pygmy Rabbit.
Merriam, N. Am. Fauna, No. 5, p. 75.
Idaho; northern Nevada; (Eastern Oregon and Washington?).

150. LEPUS INSULARIS Bryant.
Bryant, Proc. Cal. Acad. Sci. 2d, ser., iii, p. 92.
Espiritu Santo Island, Lower California.

151. LEPUS ALLENI Mearns. Allen's Hare,
Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 294.
Arizona.

152. LEPUS MELANOTIS Mearns. Eastern Jackass Hare.
Mearns, *ibid*, p. 297.
Kansas; Western Texas and Indian Territory.

153. ATALAPHA TELIOTIS H. Allen.
H. Allen, Proc. Am. Phil. Soc. xxix, Feb. 11, 1891, p. 5.
Southern California?

154. VESPERTILIO CILIOLABRUM Merr.
Merriam, Proc. Biol. Soc. Wash. iv, Dec. 17, 1886, p. 1–4.
Kansas and New Mexico.

155. VESPERTILIO LONGICRUS True.
True, Science, viii, Dec. 24, 1886, p. 528.
Puget Sound, Washington.

156. VESPERTILIO MELANORHINUS Merr. Black-nosed Bat.
Merriam, N. Am. Fauna, No. 3, p. 46.
San Francisco Mountain, Arizona.

157. MOLOSSUS CALIFORNICUS Merr.
Merriam, *ibid*, No. 4, p. 31.
Alhambra, Los Angeles County, California.

158. NYCTINOMUS FEMOROSACCUS Merr.
Merriam, *ibid*, No. 2, p. 23.
Colorado Desert, California.

159. NYCTINOMUS MOHAVENSIS Merr.
Merriam, *ibid*, p. 25.
Fort Mojave, Arizona.

160. EUDERMA MACULATUM (J. A. Allen).
*Histiotus maculatus* Allen, Bull. Am. Mus. Nat. Hist. iii, 2, Feb. 20, 1891, p. 195.
Los Angeles County, California.

161. SOREX PERSONATUS Geoffroy.
Geoffroy, Mém. du Muséum, xv, 1827, 122–125.
Labrador to Massachusetts, Ohio to Nebraska.

162. SOREX RICHARDSONII Bachman.
Bachman, Journ. Acad. Nat. Sci. Phila. vii, 1837, p. 383.
Revived by Merriam, Ann. Rept. Dept. Agr. 1887 (1888), p. 435.
Canada.

163. SOREX MONTICOLUS Merr. Mountain Shrew.
Merriam, N. Am. Fauna, No. 3, p. 43.
San Francisco Mountain, Arizona.

164. SOREX IDAHOENSIS Merr. Idaho Shrew.
Merriam, *ibid*, No. 5, p. 32.
Salmon River and Saw Tooth Mountains, Idaho.

165. SORREX MERRIAMI Dobson.
Dobson, Mon. Insectivora, part iii, fasc. 1, May, 1890, pl. xxiii.
Fort Custer, Montana.

166. SOREX DOBSONI Merr. Dobson's Shrew.
Merriam, *ibid*, p. 33.
Saw Tooth Mountains, Idaho.

167. SOREX VAGRANS SIMILIS Merr.
Merriam, *ibid*, p. 34.
Salmon River and Pahsimeroi Mountains, Idaho.

168. SOREX HYDRODROMUS Dobson.
Dobson, Ann. & Mag. Nat. Hist., 6th ser. iv, 1889, p. 372.
Unalaska Island, Aleutian Islands.

169. SOREX ALBIBARBIS (Cope).
*Neosorex albibarbis* Cope, Proc. Acad. Nat. Sci. Phila., 1862, p. 188.
Revived by Merriam, Proc. Biol. Soc. Wash. vii, Apr. 13, 1892, p. 25.
Franconia Mountains, New Hampshire.

170. BLARINA BREVICAUDA CAROLINENSIS (Bach.)
*Sorex carolinensis* Bachman, Journ. Acad. Nat. Sci. Phila. vii, pt. 2, 1837, p. 366.
Type from South Carolina.

171. SCALOPS ARGENTATUS TEXANUS Allen.
Allen, Bull. Am. Mus. Nat. Hist. iii, 2, April 29, 1891, p. 221.
Presidio County, Texas.

172. MEPHITIS ESTOR Merr.
Merriam, N. Am. Fauna, No. 3, p. 81.
San Francisco Mountain, Arizona.

173. SPILOGALE GRACILIS Merr.
Merriam, *ibid*, p. 83.
Grand Cañon of the Colorado, Arizona.

174. SPILOGALE INTERRUPTA (Raf.)
Revived by Merriam, *ibid*, No. 4, p. 8.
Kansas.

175. SPILOGALE RINGENS Merr.
Merriam, *ibid*, p. 9.
Hale County, Alabama.

176. SPILOGALE INDIANOLA Merr.
Merriam, *ibid*, p. 10.
Gulf Coast of Texas (?).

177. SPILOGALE LUCASANA Merr.
Merriam, *ibid*, p. 11.
Cape St. Lucas, Lower California.

178. SPILOGALE LEUCOPARIA Merr.
Merriam, *ibid*, p. 11.
Mason County, Texas.

179. SPILOGALE SAXATILIS Merr.
Merriam, *ibid*, p. 13.
Provo, Utah.

180. SPILOGALE PHENAX Merr.
Merriam, *ibid*, p. 13.
Marin County, California.

181. SPILOGALE PHENAX LATIFRONS Merr.
Merriam, *ibid*, p. 15.
Oregon and Washington, west of Cascade Mountains.

182. SPILOGALE PHENAX ARIZONÆ Mearns. Arizona Striped Skunk.
Mearns, Bull. Am. Mus. Nat. Hist. iii, 2, p. 231.
Fort Verde, Arizona,

183. TAXIDEA AMERICANA NEGLECTA Mearns.
Mearns, *ibid*, p. 250.
Northern California.

184. PUTORIUS CULBERTSONI Baird MS.
Coues, Fur-bearing Animals, 1877, p. 136.
Revived by Merriam, Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 25.
Fort Laramie, Wyoming; Fort Union, Montana.

185. PUTORIUS ARIZONENSIS Mearns. Arizona Weazel.
Mearns, *ibid*, p. 234.
Mountains and high plateau region of Arizona, down to the lower limit of the forest zone of *Pinus ponderosa*.

186. MUSTELA CAURINA Merr.
Merriam, N. Am. Fauna, No. 4, p. 27.
Chehalis County, Washington.

187. CANIS NUBILUS Say. Timber Wolf.
Revived by Merriam, *ibid*, No. 5, p. 82.

188. UROCYON VIRGINIANUS SCOTTII Mearns. Scott's Fox.
Mearns, Bull. Am. Mus. Nat. Hist. iii, 2, p. 236.
Southern California; Arizona and western New Mexico.

189. VULPES MACROTIS Merr.
Merriam, Proc. Biol. Soc. Wash. iv, 1886–88, p. 135.
Southern California.

190. LYNX BAILEYI Merr.

Merriam, N. Am. Fauna, No. 3. p. 79.

Arizona.

ELIMINATED.

TAMIAS MINIMUS MELANURUS Merr.

Merriam, N. Am. Fauna, No. 4, p. 22.

Proves to be a phase of the molt of *T. m. pictus*. (Cf. Merriam, N. Am. Fauna, No. 5. p. 46, foot-note.)

TAMIAS ASIATICUS PALLIDUS Allen.

A synonym of *T. minimus* (Cf. Allen, Bull. Am. Mus. Nat. Hist. ii, 1 ,1890, p. 113).

SITOMYS AMERICANUS DESERTICOLUS (Mearns). Desert Deer Mouse.

*Hesperomys leucopus deserticolus* Mearns, Bull. Am. Mus. Nat. Hist. ii, 4, p. 285.

Identical with *Sitomys a. sonoriensis*.

VESPERUGO MERRIAMI Dobson.

Dobson, Mon. Insectivora, pt. iii, fasc. 1, May, 1890, pl. xxiii.

Identical with *Vesperugo hesperus* (Cf. True, Proc. U. S. Nat. Mus. x, Aug. 6, 1888, p. 515).

RANGIFER TARANDUS (Linn.)

## THE DISTRIBUTION OF THE FLORA OF THE CAPE REGION OF BAJA CALIFORNIA.*

BY T. S. BRANDEGEE.

The Cape Region of Lower California is a mountainous extent of country, about 80 miles long and 30 wide, situated mostly between the twenty-third and twenty-fourth degrees of north latitude. At one time, it may have been an island, and have been separated from the northern portion of the peninsula by a wide sheet of water then connecting the Pacific Ocean with the Gulf of California, now a sandy plain and upland hardly rising more than one hundred and fifty feet above the level of the sea. The northern direction taken by the main mountain ranges of the region is followed by the islands Espiritu Santo, San José and Santa Catalina out into the Gulf of

* A list of plants of the Cape Region of Baja California is published in Proc. Cal. Acad. Ser. 2, vol. iii, 108, and a number of additions will soon appear in the publications of the same society.

California, and Ceralbo Island, east of La Paz, perhaps represents the continuation of the Coast Range in the same direction.

Lower California is a Mexican Territory; divided into two departments, and the Cape Region forms a portion of the Department of the South, which has for its capital La Paz.

This region, although small, on account of its position with respect to the peninsula and its distance from the main land of Mexico, possesses a flora in part endemic, in part common, to that of other countries, which by its distribution and peculiarities seems to be worthy of the publication of the following notes and table.

The mountains, according to the maps of the Coast Survey, reach nearly to a height of 6,000 feet above the level of the sea; their summits in winter are cool and pleasant, with occasional frosts at night and sometimes ice a quarter of an inch thick is formed on standing water. Clouds envelope the highest portion from June to September, and then thunder storms are frequent. In the lower altitudes, frosts are unknown and the heat is what would be expected in a region situated about the Tropic of Cancer and in the northern limit of growth of the cocoanut, the guava and the aguacate.* The winds from the ocean and gulf blowing over this narrow strip of land serve somewhat to reduce the heat of the sun's rays during the day and render the nights not unpleasant during the hottest time of the year.

The year is divided into the wet and dry seasons. The rains of the wet season are expected between June and September; they come mostly in the form of showers and seem to be unequally distributed over the region. During one of my visits, the vegetation about San José del Cabo was green and growing as the result of many showers, while about La Paz every plant was dry and withered. The lower elevations, excepting at the time of rains, are dry, and running water is rarely found except in the San José River, about Todos Santos, San Bartolomè and a few other places; but near the tops of the mountains, some small streams run throughout the year some distance downward, but are soon lost amongst the rocks and sand. Some years no rains fall except on the mountain tops,

*The fruit of this plant, which is too sparingly found in our markets, is commonly known as "alligator pear," a rather unlovely corruption of its Spanish name.

and one time of drought, when none fell upon the low lands during more than thirty months, made a lasting impression on the inhabitants.

During the dry season most of the vegetation is in a state of rest, many of the bushes or small trees are leafless, the annuals have disappeared and the dry stalks of herbaceous perennials mark the place from which a new growth will rapidly appear after the first summer rain. This region is usually spoken of by travelers who have sailed along its Pacific Coast and rounded the rocky promontory of Cabo San Lucas, as a forbidding and barren country, and so it is until the summer rains bring life to the vegetation. Residents of a temperate climate, where the change from winter to summer is gradual and the fullness of vegetable life is not reached until the first warmth of spring has become the heat of summer, cannot realize the sudden change that comes over a tropical region, when at the hottest time of the year heavy rains cause immediately every leaf to appear and every bud to grow.

The Cape Region is quite thickly covered with large bushes and small trees with an abundance of climbing and twining plants using them for supports. These altogether sometimes become so dense that it is impossible to ride or walk between them, and to go through them is usually not to be thought of on account of the spines and thorns.

The most conspicuous plants of the lower elevations on account of their abundance, their size and the showiness of their flowers are: *Fouquieria spinosa*, *Sida Xanti*, *Abutilon Xanti*, *Hibiscus ribifolius*, *Esenbeckia flava*, *Cardiospermum Halicacabum*, *Mimosa Xanti*, *Lysiloma candida*, *Calliandra Californica*, *Acacia filicina*, *Cereus Pringlei*, *pecten-aboriginum*, *gummosus & Thurberi*, *Dysodia speciosa*, *Viguiera deltoidea & tomentosa*, *Bebbia atriplicifolia*, *Plumiera acutifolia*, *Ipomœa aurea*, *Calophanes peninsularis*, *Beloperone Californica*, *Justicia Palmeri*, *Hyptis tephrodes & lanifolia*, *Antigonum leptopus*, *Yucca baccata*, and others that perhaps deserve mention. The Burseras are very abundant and well distributed throughout the region, but their flowers are insignificant although the fruit is somewhat conspicuous; and equally deserving of notice, for similar reasons are Karwinskia, Cyrtocarpa, *Pithecolobium flexicaule*, Albizzia, and *Ipomœa bracteata*. Other plants are extremely abundant in certain localities, and some are confined to small areas where they

form a large part of the vegetation. The sands of the sea shore from Todos Santos to San José abound in *Euphorbia leucophylla*, and *Ipomœa Pes-capræ;* Rhachidospermum and Martynia are usually in company with them; the fences and hedges about the fields and gardens are the home of the tall climbing Asclepiads; the lagoons near La Paz are filled with mangrove *(Rhizophora Mangle)*, and the saline flats of their vicinity produce most of the chenopods of the flora. The high mountain flora consists mostly of one species of pine *(Pinus cembroides)*, oaks, madroño and Nolina, with some cottonwoods and willows along the streams, and with smaller plants, such as Lopezia, Heterotoma, Lobelia, Dysodia, Eupatorium, Sphacele. Gilia, ferns, etc., growing amongst them.

Although most of the vegetation, especially that of the lower elevations, blooms during the rainy season, there are some notable exceptions. Some plants are in flower during the whole year, but produce a greater abundance either in spring or the "rainy season." The scarlet flowers of Justicia, Beloperone and Calliandra, can be found at any time, but are most common in March and April. Rubus, Heterotoma, Sphacele, of the high mountains, and Eucnide, most of the Daleas, Tephrosia, Fouquieria, Viguiera, *Perityle crassifolia* of the lower elevations, are examples of plants that are in flower the whole year, but their blossoms are most abundant during the rainy season.

The following plants belonging to the flora of the mountain tops blossom only during the first months of the year, in the "dry season:" Thalictrum, Ranunculus, Stellaria, Sagina, Hypericum, Nasturtium, Geranium, Trifolium, Hosackia, Prunus, Fragaria, Heteromeles, Ribes, Epilobium, Rumfordia, Perezia, Lobelia, Arbutus, Gilia, Erythræa, Mimulus, Sibthorpia, Brunella, Polygonum. Populus, Salix, Epipactis, Sisyrinchium, Juncus, Carex, Tripsacum, Festuca. All these genera, with two or three exceptions, belong to a temperate climate and are found within the tropics only on high mountains. The fact that they retain the habit of blooming in the spring contrary to that of the mass of vegetation of the region is a most interesting one. With the advent of the rains comes a great crowd of flowers such as Desmodiums, Œnothera, Lopezia, Cyclanthera, Begonia, Mitracarpus, Valeriana, Stevia, Viguiera, Carminatia, Baccharis, Verbesina, Heterospermum, Bidens, Dysodia, Tagetes, Buchnera, Clevelandia, Dicliptera, Mirabilis, and most of

the orchids and ferns, etc., belonging in general to a more southern flora than those of the spring.

Amongst the plants growing at lower elevation are the following that flower in the springtime: *Sisymbriun crenatum*, Atamisquea, *Abutilon Californicum*, Vitis, Sapindus, Lupinus, Erythrina, *Cæsalpinia placida*, Prosopis, *Acacia Farnesiana* and *Wrightii*, Lysiloma, *Pithecolobium Mexicanum*, Cotyledon, Lythrum, Mamillaria, *Cereus pecten-aboriginum*, *Pringlei*, *Schottii* and *Thurberi*, *Diodia crassifolia*, Eryngium, Hofmeisteria, *Pluchea odorata*, *Buddleia crotonoides*, *Samolus ebracteatus*, Phacelia, Nama, *Euphorbia Xanti* and two or three Agaves. This collection of names, unlike that of the mountain spring-blooming plants, does not remind one of a northern flora. It might be expected that Lupinus, Lythrum, Samolus, Phacelia, and Nama, would blossom in the spring, but that habit does not seem fit for such semi-tropical genera as Lysiloma, Erythrina, Albizzia, Pithecolobium, etc.

It is often impossible to decide with certainty whether a plant is native, or whether it should be considered an immigrant recently introduced by the agency of man. Conocarpus, for instance, is a rare bush of the southern shores and belongs to the maritime flora of tropical climates, a flora represented along the coast by several species of plants but, though probably derived from the south, does not belong to the class generally meant by "introduced plants."

The weeds of the fields and trails, certainly derived from other regions, are: *Malva borealis*, *Brassica nigra*, *Melilotus parviflora*, *Momordica charantia*, *Xanthium strumarium*, *Sonchus oleraceus*, *Polygonum acre*, *Desmodium scorpiurus*, and there are others more common; the universally distributed weeds of towns and cultivated grounds, that are not so evidently introduced, these are: *Portulaca oleracea*, *Sida rhombifolia*, *Cassia Absus & Tora*, *Mollugo verticillata & cerviana*, Richardia, Amarantus, and Euphorbia.

Only four of the genera of the Cape Region are supposed to be endemic, and three of them are certainly not very distinct from their nearest relatives. The most distinct, Coulterella, has been found only along the gulf shore, east from La Paz, but as it is strictly a maritime plant it is to be expected from neighboring coasts.

The annexed table, showing in a condensed form the geographical distribution of the flowering plants and ferns and

their relation to the floras of neighboring regions, especially the Mexican main land, is based upon 732 species. These are the result of collections made by Dr. Hinds of H.M.S. Sulphur in 1839, at Cabo San Lucas; by L. J. Xantus de Vesey in 1859–1860, about the same place; by Dr. Edward Palmer at La Paz in 1890, and by the writer at various localities during three trips in 1890 and 1892. Seventy-two species or nearly ten per cent. of the whole number seem to be endemic and future exploration together with the identification of unnamed specimens may increase this proportion, although a more complete knowledge of the botany of Sinaloa and Sonora will probably show that some plants now considered peculiar to the Cape Region only appear so on account of our ignorance concerning their distribution. Three hundred and sixty-two of the Cape Region species are found growing on the peninsula from Magdalena Bay and Comondu northward, and nearly one-half of this number extend into Alta California; sixty-four of them are peculiar to the peninsula.

Mr. Hemsley in Biologia Centrali-Americana, iv, 139, considers Mazatlan the southern limit of the North Mexican flora upon the west coast; assuming this to be correct, nearly five hundred of the species belong to that flora, and with few exceptions they all belong to the flora of Sonora.

The adjacent mainland, Sinaloa, has not been as well explored botanically as Sonora, but judging from our scanty data the Mexican part of the Cape Region flora bears much less resemblance to it than to the more northern Sonora, and the flora as a whole is decidedly that of Sonora and not an extension of that of Alta California southward as has usually been supposed. The few plants that probably belong to a more southern flora are found along the shore or in the southeast about San José and Miraflores.

Some of these semi-tropical maritime and brackish-water plants are found also on the southern end of the Peninsula of Florida. Rhizophora, Conocarpus, Avicennia, Laguncularia, *Ipomæa Pes-capræ* and *acetosæfolia* and *Scævola Plumieri* are common to American tropical shores, and reach their northern limit at about the same latitude on the Peninsula of Baja California as on that of Florida. The number common to this region and Florida, however, is not large, and of about twenty-five having such wide spread distribution, some like *Samolus ebracteatus* and *Centunculus mini-*

*mus* are found across the continent, while others may by future exploration have their now apparently widely separated habitats connected along a more southern route.

The number of genera in the ninety-nine orders found in the region is three hundred and ninety, and two hundred and thirty of them are represented by a single species, the flora being essentially insular the proportion of genera to species is large as in island floras. The largest genera are: Euphorbia with about twenty species, Cereus with nine, Acacia nine, Desmodium eleven, Cassia seven, Dalea seven, Ipomæa fourteen, etc. Leguminosæ, the largest order, has ninety-five species that are in most cases widely distributed throughout the region and abundant, so that this class of plants is the predominating one of the region. The second largest is Compositæ of eighty species; some of them are very common and some such as Franseria, Eupatorium, Brickellia, become almost arborescent. Euphorbiaceæ has forty-eight, many of them small prostrate species of the genus Euphorbia, but one species of Phyllanthus is a small tree. Malvaceæ has twenty-two, Graminæ fifty-two, Filices twenty-two, Convolvulaceæ twenty-five, Acanthaceæ seventeen. The relative positions of Leguminosæ and Compositæ in the flora of the world and that of Mexico are reversed and other large orders occupy different positions in the scale, but the region considered is so small that such comparisons have little value.

By the term "Mountain Flora" is meant those plants growing only upon or very near to the top of the highest ridges and summits of the mountains. Some plants of the lower elevations, such as Heterospermum, Behria, Centunculus, grow also up the mountains to their highest elevations, and others of the mountains are washed down the streams to the lower elevations, especially by the waters of the San José River; so that such strictly mountain plants as Clevelandia, Heterotoma and others can sometimes be found in damp stream beds, but the great mass of the mountain flora is peculiar to the high elevations. The hundred and forty-eight species belong to a hundred and seventeen genera; the orders containing the greatest number of species are: Filices with sixteen, Rosaceæ six, Leguminosæ fourteen, Compositæ twenty-one, Caryophyllaceæ six, Orchidaceæ nine. The largest genera are: Desmodium with three species, Notholæna of three; several others have two, but most of them are represented by but a single species. Forty-two of the hundred and forty-eight grow also in Alta California and ninety-five

are found in Sonora, while seventeen are considered endemic to these mountain tops. These figures, when compared with the flora of the lower elevations, show a slightly larger proportion of endemic species.

| | Number of Species. | Peculiar to the Cape Region. | Also in Northern Baja California. | Found in Mexico. | High Elevation. | Lower Elevation. |
|---|---|---|---|---|---|---|
| Ranunculaceæ | 3 | ...... | 1 | 2 | 2 | 1 |
| Papaveraceæ | 1 | ...... | 1 | 1 | ...... | 1 |
| Cruciferæ | 6 | 1 | 5 | 3 | 3 | 3 |
| Capparidaceæ | 4 | 1 | 3 | 3 | ...... | 4 |
| Cistaceæ | 2 | ...... | ...... | 2 | 2 | ...... |
| Violaceæ | 2 | 1 | 1 | 1 | ...... | 2 |
| Bixineæ | 1 | ...... | ...... | 1 | ...... | 1 |
| Polygalaceæ | 6 | 1 | 4 | 4 | 2 | 4 |
| Caryophyllaceæ | 11 | 4 | 4 | 7 | 6 | 5 |
| Portulacaceæ | 7 | ...... | 2 | 7 | ...... | 7 |
| Tamariscineæ | 1 | ...... | 1 | 1 | ...... | 1 |
| Hypericaceæ | 2 | ...... | ...... | 2 | 2 | ...... |
| Malvaceæ | 22 | 2 | 17 | 13 | 1 | 21 |
| Sterculiaceæ | 6 | 1 | 3 | 5 | ...... | 6 |
| Tiliaceæ | 1 | ...... | 1 | 1 | ...... | 1 |
| Malpighiaceæ | 2 | ...... | ...... | 2 | ...... | 2 |
| Zygophyllaceæ | 7 | ...... | 6 | 5 | ...... | 7 |
| Geraniaceæ | 2 | ...... | 2 | 2 | 2 | ...... |
| Rutaceæ | 3 | 1 | ...... | 2 | ...... | 3 |
| Simarubeæ | 1 | ...... | ...... | 1 | ...... | 1 |
| Burseraceæ | 5 | 1 | 3 | 3 | ...... | 5 |
| Olacineæ | 1 | ...... | 1 | ...... | ...... | 1 |
| Celastraceæ | 1 | ...... | 1 | 1 | ...... | 1 |
| Rhamnaceæ | 4 | ...... | 2 | 4 | ...... | 4 |
| Vitaceæ | 3 | ...... | 1 | 2 | 1 | 2 |
| Sapindaceæ | 8 | ...... | 2 | ...... | 1 | 7 |
| Anacardiaceæ | 3 | ...... | 1 | 2 | 2 | 1 |
| Leguminosæ | 95 | 9 | 34 | 67 | 14 | 81 |
| Rosaceæ | 5 | ...... | 1 | 5 | 5 | ...... |
| Saxifragaceæ | 1 | ...... | ...... | ...... | 1 | ...... |
| Crassulaceæ | 2 | 1 | 1 | ...... | ...... | 2 |
| Rhizophoraceæ | 1 | ...... | 1 | 1 | ...... | 1 |
| Combretaceæ | 2 | ...... | 1 | 1 | ...... | 2 |
| Lythraceæ | 3 | ...... | 1 | 3 | 1 | 2 |
| Onagraceæ | 8 | ...... | 6 | 5 | 3 | 5 |
| Loasaceæ | 3 | ...... | 2 | 2 | ...... | 3 |
| Turneraceæ | 2 | ...... | ...... | 2 | ...... | 2 |
| Passifloraceæ | 1 | .... | 1 | 1 | ...... | 1 |
| Cucurbitaceæ | 9 | 2 | 2 | 4 | 1 | 8 |
| Begoniaceæ | 1 | 1 | ...... | ...... | 1 | ...... |
| Cactaceæ | 16 | 3 | 8 | 11 | 1 | 15 |
| Ficoideæ | 4 | ...... | 4 | 4 | ...... | 4 |
| Umbelliferæ | 3 | ...... | 2 | 1 | 1 | 2 |
| Cornaceæ | 1 | ...... | ...... | 1 | 1 | ...... |
| Rubiaceæ | 15 | 5 | 3 | 9 | 2 | 15 |
| Valerianaceæ | 1 | ...... | ...... | 1 | 1 | ...... |
| Compositæ | 80 | 14 | 45 | 43 | 21 | 59 |

| | Number of Species. | Peculiar to the Cape Region. | Also in Northern Baja California. | Found in Mexico. | High Elevation. | Lower Elevation. |
|---|---|---|---|---|---|---|
| Goodeniaceæ | 1 | ...... | ...... | 1 | ..... | 1 |
| Lobeliaceæ | 2 | 1 | ...... | 1 | 2 | ...... |
| Ericaceæ | 1 | ...... | 1 | 1 | 1 | ...... |
| Primulaceæ | 3 | ...... | 2 | 2 | 1 | 2 |
| Ebenaceæ | 1 | 1 | ...... | ...... | ...... | 1 |
| Oleaceæ | 1 | ...... | ? | ...... | ...... | 1 |
| Apocynaceæ | 2 | ...... | 1 | 1 | ...... | 2 |
| Asclepiadaceæ | 10 | ...... | 7 | 8 | ...... | 10 |
| Loganiaceæ | 2 | 1 | ...... | 1 | ...... | 2 |
| Gentianaceæ | 3 | ...... | 1 | 2 | 2 | 1 |
| Polemoniaceæ | 2 | ...... | 1 | 1 | 1 | 1 |
| Boraginaceæ | 14 | ...... | 9 | 10 | ...... | 14 |
| Hydrophyllaceæ | 2 | ...... | 2 | 1 | ...... | 2 |
| Convolvulaceæ | 25 | ...... | 12 | 21 | 1 | 24 |
| Solanaceæ | 19 | 1 | 14 | 14 | 1 | 18 |
| Scrophulariaceæ | 14 | 1 | 8 | 10 | 1 | 13 |
| Bignoniaceæ | 2 | ...... | 1 | 2 | ..... | 2 |
| Orobanchaceæ | 1 | ...... | 1 | ...... | 1 | ...... |
| Pedaliaceæ | 1 | ...... | 1 | 1 | ...... | 1 |
| Acanthaceæ | 17 | 4 | 9 | 8 | 1 | 16 |
| Verbenaceæ | 8 | 2 | 4 | 3 | ...... | 8 |
| Labiatæ | 13 | 1 | 7 | 8 | 4 | 9 |
| Plantaginaceæ | 2 | ...... | 2 | 2 | 2 | ...... |
| Nyctaginaceæ | 9 | 1 | 5 | 6 | 1 | 8 |
| Polygonaceæ | 4 | ...... | 4 | 3 | 1 | 3 |
| Amarantaceæ | 10 | ...... | 6 | 7 | 1 | 9 |
| Chenopodiaceæ | 7 | ...... | 7 | 6 | ...... | 7 |
| Batideæ | 1 | ...... | 1 | ...... | ...... | 1 |
| Phytolaccaceæ | 4 | ...... | 3 | 4 | ...... | 4 |
| Aristolochiaceæ | 2 | ...... | ...... | 2 | ...... | 2 |
| Piperaceæ | 2 | ...... | 1 | 2 | 1 | 1 |
| Loranthaceæ | 2 | ...... | 2 | 1 | ..... | 2 |
| Euphorbiaceæ | 48 | 4 | 26 | 30 | ...... | 48 |
| Urticaceæ | 2 | ..... | 2 | 1 | ...... | 2 |
| Cupuliferæ | 3 | ...... | ? | ? | 2 | 1 |
| Salicaceæ | 4 | 1 | 3 | 3 | 2 | 2 |
| Coniferæ | 1 | ...... | ...... | 1 | 1 | ...... |
| Orchidaceæ | 9 | ...... | 1 | 9? | 9 | ..... |
| Bromeliaceæ | 1 | ...... | ...... | 1 | ...... | 1 |
| Iridaceæ | 2 | ...... | 1 | 1 | 1 | 1 |
| Amaryllidaceæ | 6 | ...... | 2 | 6 (?) | ...... | 6 |
| Liliaceæ | 4 | 2 | 1 | 3 | 1 | 3 |
| Commelinaceæ | 5 | 1 | ...... | 4 (?) | ...... | 5 |
| Palmaceæ | 2 | ...... | 1 | 1 | 1 | 1 |
| Aroideæ | 1 | ...... | ...... | 1 | ...... | 1 |
| Lemnaceæ | 1 | ...... | 1 | 1 | 1 | ...... |
| Alismaceæ | 1 | ...... | 1 | 1 | ...... | 1 |
| Naidaceæ | 2 | ...... | 2 | 2 | 1 | 1 |
| Juncaceæ | 1 | ...... | 1 | 1 | 1 | ...... |
| Cyperaceæ | 10 | ...... | ? | ? | 2 | 8 |
| Gramineæ | 52 | 2 | 29 | 43 | 8 | 44 |
| Filices | 22 | 1 | 5 | 21 | 16 | 6 |
| | 732 | 72 | 362 | 494 | 146 | 586 |

# FOOD OF THE GROUSE AND MOUNTAIN QUAIL OF CENTRAL CALIFORNIA.

BY L. BELDING.

In autumn the grouse *(Dendragapus obscurus fuliginosus)*, of the Sierra Nevada at about seven thousand feet altitude, has a great variety of food as I have ascertained by dissecting many of them. The thimbleberry *(Rubus Nutkanus)*, appears to be its favorite article of diet, and next to this, the service berry *(Amelanchier alnifolia)*. Several kinds of wild currants and gooseberries, including *Ribes sanguineum* and *R. Menziesii* and red elderberries *(Sambucus racemosa)* are hardly less acceptable. Berries of manzanita *(Arctostaphylos pungens* and *A. Nevadensis)* and the mountain twin berry *(Lonicera conjugialis)*, the huckleberry *(Vaccinium occidentale)* and of the mountain ash *(Pyrus sambucifolia)*, are also eaten. The seeds of lupines, of *Polygonum polymorphum*, of the very abundant false sun-flower *(Wyethia mollis)*, of caraway *(Glycosma)*, and acorns of the dwarf oak *(Quercus chrysolepis* var. *vacciniifolia)*, add to the variety. The last two named are also eaten by deer and Indians. I have seen Washoe Indians have a pile of not less than thirty bushels, of nicely cleaned seeds of *Glycosma occidentale*. After the young grouse are hatched the mother bird takes them to alder and willow thickets where they find seclusion and water. Here they also find some insect food (which seems to be very necessary to young birds of most species), and a species of native red clover, the green leaves and heads of which supply them, for a time, with nearly all the food they require.

Old as well as young birds appear to be very fond of the mitrewort *(Mitella Breweri)*, which grows in these damp, shady situations. About the middle of August the females, with their broods, begin to change their haunts and range higher in the mountains, and then feed partly upon the foliage of fir trees *(Abies concolor* and *magnifica)*, and hemlock spruce *(Tsuga Pattoniana)*, the latter being apparently preferred. The old males feed upon the foliage of these conifers nearly all the year and during the winter when everything is covered with snow all grouse must subsist upon it.

Some years, late summer frosts destroy the berry and seed crops and then the grouse are limited to a diet of a few kinds of vegetable food, grasshoppers and other insects. One such year, during Sep-

tember, I found them feeding almost exclusively on the fallen dried male flowers of the yellow pine *(Pinus ponderosa)*.

After, about the first of October, these grouse go into the fir trees of the high peaks and are seldom seen. The game law which prohibits their being shot prior to this time is almost equivalent to prohibiting shooting them at all. The open season should begin about the middle of August, when young birds are about two-thirds grown, at which time they are a great luxury, whereas an old bird is no better than an old hen, if as good. Sportsmen, who are familiar with grouse, avoid shooting the adults.

The mountain quail *(Oreortyx pictus plumiferus)*, which are so plentiful in the high mountains in summer, are only summer residents there. They usually spend the winter below the snow line, but as it is not possible to tell just where that is, or rather where it is going to be, they are sometimes caught in snow storms, but I have been astonished at the correctness of their apparent forecast of different winters. A few birds winter high in the mountains, but I think they are parts of flocks which were nearly annihilated, or young birds which got scattered and lost, and a few that were wounded and survived.

They begin their journey on foot from the summit and east slope to the foothills, a little after the first of September, and by the first of October, when the game law allows them to be shot, they have nearly all escaped from the mountain hunters to run the gauntlet of those lower down, on the west slope. In some respects they are very stupid birds, in others, quite the reverse. When they are going from their summer to their winter resorts, birds of a flock can all, or nearly all, be shot if the flock can be turned from its course and scattered. They soon begin to call together and will nearly always respond to a hunter's imitation of their call. The loud pleasing call of the male in breeding season is not easily imitated nor described, though apparently consisting of a single note, which is sometimes varied a little. The service berry is the staple article of their food in fall, but they eat more or less of the different kinds of berries which the grouse eat. I suppose they, as well as the grouse, eat berries of the wild coffee *(Rhamnus Californica)*, but I have no data for a positive opinion. They also eat the acorn of the dwarf oak and seeds of the snow bush *(Ceanothus cordulatus)*, and seeds of many small plants. I do not know that they eat any of the

foliage mentioned as the food of the grouse, but they probably eat leaves of clover early in summer, just as valley quail do in winter. The juveniles eat a great many ants.

Some seasons, when there are no berries and very few seeds, they live almost entirely upon the bulb of a species of grass, apparently *Melica bulbosa*, which grows at the head of springs and rivulets. The birds get the bulb by scratching. Such seasons they start for the foothills sooner than when food is abundant.

## ON A LEAF-MINER OF POPULUS FREMONTI.

BY C. H. TYLER TOWNSEND.

Almost every spring the cottonwoods in the town of Las Cruces, New Mexico, and its vicinity, are badly infested with a leaf-miner, which up to the present time has baffled all attempts at breeding. The cottonwood is our only native shade tree in the Mesilla Valley, there being only the one species, *Populus fremonti;* and as this insect has proven a serious pest to it, the following notes on the larva will probably be of interest, although the imago is unknown. A very brief notice of this miner was published in Insect Life, vol. 4, pp. 26–27.

It was found on April 30, 1891, that nearly every tree in the valley was most thoroughly infested, the majority of trees having almost every leaf mined out and blistered. The larvæ eat out the entire inner portion or parenchyma of the leaf, leaving the two skins whitened and inflated like blisters. They entirely and irrecoverably ruin the foliage of the tree, giving it a most desolate and dying appearance. The trees, however, gradually put forth a new set of leaves, and though they apparently soon recover their normal healthy appearance it is clearly evident that this process must be a great tax on their vitality. I have even been told that in some previous years the second crop of leaves has been likewise destroyed, but I cannot vouch for the accuracy of this statement. On the above date the larvæ were of several sizes, the largest being about seven-sixteenths of an inch in length. In general color they are nearly white, with some black dots on the anterior segments below and on the segments next the head above. Two larvæ were often found in one leaf, their mines beginning in separate parts of the leaf and gradually approaching until they coalesced.

Leaves containing larvæ were collected on May 4 of the same year, and put in a jar with earth to breed, but the larvæ all seemingly shriveled up and became hard and dried. At this date more than two-thirds of the larvæ had left the leaves.

The spring of the present year the leaves of the cottonwood had been out not more than one week when it was found, April 21, 1892, that they contained good-sized larvæ of this miner. It would therefore seem that the eggs must be deposited in the leaf-buds before the leaves appear, perhaps about the time the buds begin to swell.

On April 25 of this year, most of the larvæ were apparently full-grown, and accordingly a good number of small branches bearing leaves filled with healthy larvæ were put in a breeding cage, the branches being inserted in a receptacle which was kept filled with water. The leaves remained green and healthy for days, until all the larvæ had disappeared. The next day, April 26, a large number of the larvæ had already left the leaves, and were crawling on the earth in the bottom of the cage. They seemed to manifest a migratory instinct, and did not appear inclined to bury themselves at once in the soil. The migratory larva seems to lose the blackish dots on the anterior segments both above and below, and is entirely of a whitish color and somewhat shorter than before. Two or three of them were noticed going into the earth, but they were subsequently found perfectly hard and dried, and this was likewise the fate of all the others, which shriveled up and died on top of the earth within a day or two. They would not crawl under chips which were placed within the cage. All natural conditions had been carefully studied and provided, but to no avail. On April 29, the larvæ had all left the leaves in the breeding cage. Some very small larvæ were at work on April 25, along with the apparently full-grown ones.

Five of these miners were often found in one leaf this season, but the leaves of the trees were not so totally destroyed as in 1891. In one case even seven larvæ were found in the same leaf. They all begin separately, and work till their mines meet. The two skins of the leaves then become filled with the very fine black frass or excrement of the larvæ. They feed by day, and so far as observed always with the venter toward the upper surface of the leaf. They leave the leaf by making an incision in the upper skin just in the

edge of the blistered portion from which the parenchyma has been eaten, and next the latter.

A remedy for these miners is rather hard to suggest. Perhaps an arsenical spray about the time the leaf-buds begin to swell would kill the newly-hatched larvæ when they begin to enter the leaves.

Birds and chickens seem to destroy many of them after they have left the leaves and descended to the ground. On May 4, what were supposed to be pupæ were found in the earth under a cottonwood tree, and blackbirds were reported digging them out and eating them.

It is quite certain that this miner is lepidopterous, and it will probably be found to belong to the *Tineidæ*. It seems also that there is usually but one brood annually, and perhaps the pupæ remains in the earth until the following spring.

Below is given a description of the larva:

Full-grown larva of leaf-miner on *Populus fremonti:* Elongate, creamy whitish, with six pale brownish true legs. Twelve segments beside the head, legs 5-jointed, terminal joint small, conical. Head pale tawny brownish or testaceous, with a median posterior ventral brownish marking; mouth parts darker distally. First segment (next head) with a large oblong brownish marking situated in the middle, which covers about one-half of the dorsum of segment and is divided in the middle longitudinally by a faint median whitish line or suture, and also transversely through the middle by a suture which, however, does not show as a whitish line. A median pair of brown dots on dorsum of second segment. Venter of first segment with a large brown marking in middle, venter of second and third segments with a much smaller brown spot, and venter of fourth with a still smaller brown dot. Fifth to eleventh segments each with rudiments of a pair of pro-legs, appearing as very small buds on ventral surface defined anteriorly by a pale brownish usually semilunar marking. Anal tubercle brown or blackish, except terminal and dorsal surfaces which are whitish. Head fully three-fourths width of first (next) segment; second and third segments widest and also shorter than the other segments which are all of a nearly uniform length, except sometimes the fourth which is not quite so long. Segments four to twelve often exhibit (in alcoholic specimens) a continuous longitudinal median furrow on the dorsal surface.

In some specimens the dorsal markings of the first and second segments have disappeared, or are absent, and the legs have nearly lost their pale brownish color.

Length, about 9 mm.; width of second and third segments, 2 mm.; average width of following segments, 1.5 mm.

Described from alcoholic specimens.

# NOTES ON SOME OF THE BUTTERFLIES OF THE YOSEMITE VALLEY AND ADJACENT REGION.

BY EDWIN C. VAN DYKE.

In the summer vacation of this year, I had the good fortune to be one of a camping party, traveling through the Yosemite Valley and adjacent regions in the National Park. During odd moments around camp or on the march, I found time to do a little entomological work, chiefly upon beetles and butterflies. It is of the latter that I wish to speak here, supplementing to some extent the article of Dr. Behr in Zoe, Vol. I, as well as that of Mr. Harrison G. Dyar in Entomological News, Vol. III, No. 2. In the region traversed, I had the opportunity of observing between forty and fifty species of butterflies, and concerning most of these I will here give the result of my observations.

*Papilio rutulus* Bdv.—Quite common in the lower valleys and meadows of the region, where it may be seen skirting the willow thickets or sporting around the flowers in the immediate neighborhood. Found in the Yosemite and Hetch Hetchy valleys and around Lake Eleanor. Never seen at a higher altitude than five or six thousand feet.

*Papilio eurymedon* Bdv.—Very plentiful also throughout the region, but prefers the open spaces on the hillsides to the valleys. Also often found flying at higher altitudes than the above. Most of the specimens caught were in a more or less tattered condition, which indicates that August is their last month in the mountains, at least for that brood.

*Papilio daunus* Bdv.— Several splendid specimens caught from July 23 to 26, in the Hetch Hetchy Valley, and several later on at Lake Eleanor. In both places they were caught while in the act of drinking.

*Papilio zolicaon* Bdv.—Often noticed on the ridges and tops of mountains, at altitudes not greater than eight or nine thousand feet. One was taken at the top of Sentinel Dome, July 11.

*Papilio indra* Reak.—Only one specimen seen. This crossed the Tioga road just ahead of us, when we were at an altitude of over eight thousand feet. The species is probably found at much higher altitudes than any of our Papilios, save in a few instances that of *P. zolicaon*.

*Parnassius clarius* Eversmann.—Quite common around the bogs and wet places, between Lake Tenieya and Tuolumne Meadows. The average altitude here is about nine thousand feet. In manner of flight they much resemble the species of Satyrus.

*Pieris sisymbri* Bdv.—Several of these were caught on the top of Sentinel Dome, July 11. They fly around while it is quiet, but seek shelter as soon as it begins to blow at all hard.

*Neophasia menapia* Feld.—Of this species I saw only about three specimens. They were in a yellow-pine forest on the south side of Lake Eleanor.

*Anthocharis ausonides* Bdv.—Several specimens of these, in a very fresh condition, were caught. They were found around the meadows in the lower altitudes.

*Colias eurytheme* Bdv.—Found about every meadow in the region, even up to ten thousand feet altitude. The albino female was also quite common.

*Colias behrii* Edw.—Only one specimen of this scarce butterfly was seen. This was disturbed from its resting place in the grass, while our party was crossing a small meadow on the side of Mt. Lyell. It is found on several of the high peaks around Tuolumne Meadows, as well as occasionally in the meadows themselves, but nowhere is it a common butterfly.

*Danais archippus* Fab.—Quite common up to an altitude of about six thousand feet, and is commonly seen sailing across small cañons or hovering over the milkweed. Several larvæ of it in different stages of development were also observed on the milkweed. The habits of the butterfly in the mountains do not seem to me different from those I have observed in the valleys.

*Heterochroa Californica* Butl.—Quite common in the valleys throughout the region. These butterflies have a curious habit of coursing up and down the roads and paths, much in the manner of large dragonflies.

*Limenitis lorquini* Bdv.—This species was found in about the same localities as the preceding. Neither of them were observed at higher elevations than six thousand feet.

*Argynnis monticola* Behr; *Argynnis zerene* Bdv.—These two species were always found together, the former being the most numerous generally. Very common through the mountains at altitudes below nine thousand feet. They delight in sunshine, and are

always to be found on open hillsides or other such warm spots. In view of the fact that I have found these two butterflies together here, as well as in Shasta county two years ago, it seems to me hardly possible that they are more than mere color varieties of the same species.

*Argynnis leto* Behr.—This handsome Argynnid was found quite often. It is a strong and rapid flyer, and is quite hard to capture, partly from the above cause and partly from its habit of flying around the wet places of the meadows. No females were observed by me on the entire trip.

*Argynnis egleis* Bdv.—Only three specimens of this high mountain form were captured. One was caught on the upper Tioga road, and the other two on the Lyell fork of the Tuolumne river. It strongly resembles *monticola* and *zerene* in its habits, though it is a weaker butterfly, flying slower and closer to the ground.

*Argynnis epithoræ* Bdv. — This, the smallest of the Argynnidæ found in that region, is quite common in the open regions of the high altitudes. In manner of flight this species much resembles a Melitæa or even some of the species of Satyrus.

*Melitæa palla* Bdv.—Found throughout the region traveled, up to moderate altitudes.

*Melitæa leanira* Bdv.; *Melitæa quino* Behr.—Only one specimen of each of these was captured. They were found July 9 on the north edge of the Yosemite Valley.

*Phyciodes mylitta* Edw. — Several specimens from different parts of the region traveled.

*Vanessa antiopa* Linn. — Several specimens observed. Most of them were at medium altitudes, though one was seen at the foot of Mt. Lyell at an altitude of about ten thousand feet. It ranges still higher, probably.

*Pyrameis cardui* Linn.—Very common, even up to high altitudes. This is one of our hardiest species, being often seen on some of the coldest and windiest ridges in the mountains.

*Pyrameis carye* Hbn. — Quite common, but not found at such high altitudes as the preceding.

*Pyrameis huntera* Fabr.—Several of these were seen around water courses in the lower valleys of the mountains. This does not appear to be quite as hardy a butterfly as either of the two preceding, though it is found quite late in the autumn, around the bay here.

*Junonia cœnia* Hbn.—Very common everywhere at low altitudes.

*Chionobas ivallda* Mead. — This butterfly probably reaches a higher altitude than any other butterfly found in the locality. I only captured one and that was at the base of Mt. Lyell, at an altitude of about ten thousand feet; but I have received some battered specimens taken from the Mt. Dana glacier, at a much higher altitude. This butterfly is a rapid flyer, being in this respect quite a contrast to the rest of the family of Satyrs.

*Chrysophanus helloides* Bdv.; *Chrysophanus arota* Bdv.—Several of both species seen several times in the Tuolumne Meadows and often in company with the following:

*Chrysophanus cupreus* Edw. — This beautiful little butterfly is quite common in the Tuolumne Meadows, especially in the bare and sunny spots on the hillsides.

*Thecla melinus* Hbn. — Only one specimen captured, at Lake Eleanor, July 27.

*Thecla grunus* Bdv. — Quite common on the Eagle Peak trail, coming out of the Yosemite Valley. Found about the oak *(Quercus chrysolepis)*.

*Thecla eryphon* Bdv.—Quite common along the shores of Lake Eleanor.

*Lycæna acmon* Db.-Hew. — Very common in the lower altitudes of the district.

*Lycæna battoides* Behr.—Only one specimen captured here.

*Lycæna sæpiolus* Bdv.; *Lycæna rustica* Edw.—Very common in the Tuolumne Meadows, especially the former. Found congregated in great numbers along the margins of streams and ponds.

*Eudamus tityrus* Fabr. — Two specimens captured in the Tuolumne Meadows.

*Nisoniades propertius* Lint. — Several found in the same region as the preceding.

Besides the butterflies given above, I saw many other species which I did not get near enough to identify. The region as a whole is, however, a very rich one for a lepidopterist, and is particularly interesting to one interested in geographical distribution. Looking at the Yosemite region from this standpoint, one can see how similar it is to the rest of the Sierra region north of it. The only one of the above butterflies peculiar to this one district is *Colias behrii*, the remainder being either mountain forms peculiar to the

Sierra region in general or else cosmopolitan forms and those found everywhere in the State.

To the collector from the valley and coast regions of the State this region is a new world. Here he first comes in contact with large numbers of that family of Argynnidæ which makes the mountains seem so full of insect life. This is by far the best represented of any family in the mountains of this region, with reference both to numbers and to species. *Vanessa californica* slightly outnumbers it farther north, but is not seen in this locality. The genus Papilio is also better represented here than in the lower regions. The species of Thecla, Lycæna, Chrysophanus, Pieris and Colias are represented here as well as in the valleys. Parnassius and Chionobas are of course mountain genera, seldom found at low altitudes.

This short paper, with what has been done before by others, I hope will induce more collectors to explore the above district and try to clear up some of the difficult points. Very little has yet been done, but until this region is well explored our knowledge of what the Sierras contain will necessarily be limited.*

*Most of these butterflies were named for me by Mr. J. J. Rivers.

## A NEW RUMFORDIA FROM LOWER CALIFORNIA.

With Plate xxiii.

BY T. S. BRANDEGEE.

RUMFORDIA CONNATA. Perennial, herbaceous 1–2 m. high; stems clustered, much branched near the top, glandular-pubescent: leaves ⅓–1½ dm. long, ovate, acuminate, serrate, decurrent on the petioles as a broad margin and connate into a cup often 1–2 cm. in depth, more or less filled by the hirsute pubescence; nodes as long or longer than the leaves: panicle compound: heads long-pedunculate; peduncles slender, naked: heads 4–5 cm. broad; outer involucre foliaceous, deeply 5–8 lobed, its segments nearly equalling the rays, two of them usually much broader than the others and 2-toothed at apex; inner conduplicate about ¼ the length of the outer, green and glandular on the back, acute, and three times the length of the akene; receptacle convex, the paleæ membranaceous, obliquely obtuse, somewhat boat-shaped, loosely enclosing and twice longer than the akenes: rays ♀, numerous 15–18 mm. long,

equally 3-toothed at apex, and usually with two strap-like lobes at base, the slender glandular tube nearly half as long as the limb; disk flowers long-tubular 5-toothed: stamens long-exserted minutely sagittate at base: akenes glabrous, compressed, striate, oblique at apex, somewhat clavate, curved on the back and straight on the inner edge, crowned by a thickened ring; pappus none.

Highest elevations of the mountains of the Cape region of Lower California. Not very abundant, but conspicuous, making masses of bloom a yard or more in diameter.

The oblique compressed akenes, broader at the back, remind of Madia. The description is rather fully given because the plant does not entirely agree with that of the hitherto monotypic Rumfordia. It is, however, a fault which will readily be pardoned by any one who has had to delve among the brief and vague descriptions of too many of the Mexican Compositæ.

The figure in the plate is drawn one-half natural size.

## A NEW EPILOBIUM.

With Plate xxiv.

BY T. S. BRANDEGEE.

EPILOBIUM NIVIUM. Perennial, pubescent, stems in tufts from a strong woody base: leaves oblong- or elliptic-lanceolate, pubescent on both sides 8–15 mm. long, narrowed to a short stout petiole, somewhat fascicled in the axils, the lower opposite, the upper usually alternate, all abruptly tipped with a stout subulate gland ½–1 mm. long: flowers racemose in the upper axils; pedicels shorter than the ovary: calyx tube red or reddish, abruptly enlarged above the ovary, nearly linear 5–7 mm. long, ⅔ the length of the petals; lobes spreading, at length deflexed, about 3 mm. long above the obconical throat: petals violet-purple, obcordate, 7–10 mm. long, twice the length of the longer stamens which are opposite the sepals and inserted a little higher in the tube; anthers apiculate: ovary few-about 8-ovuled; style equalling the corolla, the stigma with 4 short ultimately reflexed lobes: capsule somewhat fusiform, the few seeds being developed near the center; seeds immature, apparently smooth; coma dingy.

Collected September 25, 1892, at an altitude of 5,500 feet, on the

red shales of Snow Mountain, Lake County, in flower and young fruit.

In habit this species is strikingly like the narrower-leaved forms of the monotypic genus Zauschneria, and in conjunction with such species as *E. paniculatum* and *E. obcordatum*, make that genus untenable, there being no longer any definable and constant difference, however trivial, which can be used to separate them.

## THE HABITS AND NESTING OF PALMER'S THRASHER.

*(Harporhynchus curvirostris palmeri.)*

BY HERBERT BROWN.

In offering these notes on the habits and nesting of Palmer's and Bendire's thrashers, I question much if I can say anything new in regard to the former, inasmuch as it has long been under the observation of experienced naturalists. The bird is a common resident of this portion of the Territory, and a notable feature of feathered life in every cactus belt in Southern Arizona. Some years since, I purchased a partial albino.* I first saw it as a fledgling at a ranch about forty-five miles west of Tucson, to which place the writer had gone as one of a rescuing party; the sheriff of the county, while endeavoring to arrest an Indian horsethief, had fallen into ambush and was himself a captive. The bird had been taken from its nest under the impression that it was a young mocking-bird. When I again saw it some six months later, it was fully grown, and appar-

*In general appearance it resembled *H. c. palmeri*. Poise and shape of head, length and curve of mandibles, bold, bright yellowish gray eye and movements those of *palmeri*, but the white markings gave it somewhat of a resemblance to *M. polyglottos*. If approached by a stranger when caged, it would ruffle its feathers, open its tail like a fan and peck viciously at the hand, but to its owner, a young fellow, whose both arms had been broken by an Apache bullet, it was all love and affection. The first, fifth and ninth primary in the left wing were white, sixth, seventh and eighth brownish gray, secondaries ashy gray, tertiaries white, stems of all white feathers black. Right wing, first and fifth primaries white, sixth brownish gray, secondaries first two white, the next four brownish gray, tertiaries first brown, second brown and white, third white, upper half of greater coverts white, eighth, nine and tenth all white. Tail—eleven rectrices entirely white, barred with faint waving lines of a darker color. Back, head and breast ashy gray, throat and abdomen white, upper mandible black, lower mandible from base to angle of gonys, white.

ently as domestic as the chickens with which it freely associated. Occasionally it would become too obtrusive and draw upon itself the belligerent attention of its more powerful companions, but when struck at, like the proverbial flea, it was never there. A dozen times an hour, and off and on I watched it for nearly half a day. I expected to see it killed, but its remarkable quickness always stood its friend. One pestiferous old hen would run up to within striking distance, then slowly crane her neck in the direction of the impudent little intruder, which also as suddenly assumed a like position, and for a moment they would stand defiantly eyeing each other, when, almost too quick to be seen, the hen would deliver her blow, but only to find the enemy two feet away with its head cocked first on one side and then on the other, apparently enjoying the dangerous sport. It answered readily to the name of Dick, and was particularly fond of a mixture of chili and corn meal, and when its attention was called to a cup containing some, it would be up in an instant, and if the vessel was covered with the hand would attempt to force its mandibles between the fingers. Failing in this, it would watch eagerly for any opening it could take advantage of. It had a penchant for digging holes in the ground; the harder the earth the greater its apparent delight. This odd feature, however, is common to the *palmeri* family at all seasons of the year, but more particularly, I think, while breeding. They press their tails firmly against the ground, after the matter of the woodpecker; if the earth be dry and sandy, a perfect fusilade ot dirt is kept up. The force of the blow is downward and towards the body, but occasionally to clean the sand out they strike several sideward blows, and dirt flies for a foot in all directions. In the early spring they are commonly seen with a hard lump about the size of a pea, attached firmly underneath the point of the lower mandible, and as the lump is of adobe, which at times is found a considerable distance from their resting places, it is evident that this digging is done for a purpose. During the winter months they leave the mesas for the more sheltered bottoms where they frequent the brush fences, pomgranate and willow hedge rows bordering the ploughed fields, and then, literally, they are in mud to their eyes.

Palmer's thrasher may never be classed as a musical prodigy, but nevertheless among Arizona birds he is rivalled only by that king of American songsters, *Mimus polyglottos*. Morning, noon and

evening, perched on the topmost branch of a cholla, he is always in tune, and while his notes may perhaps be less varied than his more favored kinsman, it is none the less bold and commanding, and but for the ubiquity of his rival in song would be in demand as a cage bird.

Southern Arizona, notwithstanding its great mountain chains, if viewed from an elevated position, presents the appearance of a vast plain that ends only where the horizon seems to touch the earth, with here and there a mountain range small in comparison with the surrounding plain, set down upon it. Between the mountains lie immense mesas and valleys, as a whole, timberless and waterless, but covered with nutritious grasses, great cacti belts and other vegetation of curious growth. Here, then, is the home of the *palmeri*, and in the cholla, beset with countless spines, it builds its nest and rears its young. This class of cacti, of which the foregoing cut gives but a faint conception of its terrors, is virtually impenetrable to man and beast. Ten million of cambric needles, set on hundreds of loosely jointed spindles, woven so closely together as to apparently defy the penetration of a body however small, but the thrashers go in and out and up and through them with the ease of water running through a sieve. In some convenient fork, on a limb against the bole of the bush, or in a cavity formed by the pendent stems of the plant, the nest is most commonly built. All the spines in the vicinity of the nest are pulled off for the better protection of the young. This does not, however, always save them as I have found them once in a while, tangled and dead in the terrible burs.

The external nest of the Palmer's thrasher is made of thorn twigs avergaing in length about eight or nine inches, seldom shorter but frequently much longer. Almost invariably they are lined with a species of wire grass, but sometimes thay go astray and use other material. In external depth the nests vary according to the whims of the bird and the requirements of the site chosen, but generally they average from seven to ten inches. The inner cavity at its greatest width near the top measures from four to four and one-half inches, bottom one-half an inch to an inch narrower, rounded or flat, and from three to three and one-half inches deep. However sparsely the walls of the nest may be lined, the bottom is always thickly padded with dried grass into which the eggs frequently sink one-half their depth, and in this condition hatch. There are, of

course, many exceptional nests. Some remarkable for the oddity of their construction, others for their bulkiness and still others for the flimsy manner in which they are put together. Have many records of such; a few instances, however, will suffice to show the peculiar ideas of the birds when they depart from their usual seven by ten building. One nest was built on the ruins of three others and probably represented as many successive broods, and gave the interior of the cholla the appearance of having been solidly filled in with dead sticks. Exterior diameter of the nest 20 inches, depth 36 inches, cavity across the top 4½ inches, bottom 3 inches, depth 6 inches, but lined only about 4 inches up with baling rope, hog bristles and grass. A second had an external diameter of 14 inches, depth 12 inches, interior diameter top of cavity 5 inches, bottom 2 inches and depth 9 inches, but lined with grass and feathers for two inches only, the other seven inches being naked sticks. The peculiarity of another was that the bird in leaving the nest went through a well built piece of cribbing rather more than ten inches deep, which stood at an angle of about 70 degrees with the top of the nest. The sticks forming the cribbing were from six to eight inches long and straight, the aperture was about four and one-half inches in the clear, being rather longer one way than the other. One edge of the cribbing lay solidly on the nest, the opposite side being open sufficiently to admit the body of the bird, giving the cribbing the appearance of having at some time been tipped from the perpendicular. I broke sufficient of the cactus burs away to expose the open side of the nest, then secreted myself to watch events. Both birds soon returned to the nest, but becoming alarmed again left apparently for good, but in the course of half an hour one again came back and was presently followed by the other. After a general inspection of the premises the female went on the nest, going in under the open edge of the cribbing, but on being approached left the nest by going up through the cribbing as she did when first disturbed. For a third time I saw her make her entrance and exit as described. The nest contained three slightly incubated eggs. In the spring of 1889 I noted several nests made almost entirely of flowering weeds. This came from the nature of the vegetation in the immediate vicinity of the cholla belt in which the nests were placed.

There appears to be no fixed time for the opening of the nesting

season, which alternates between the latter part of February and the beginning of April. At first I was inclined to attribute this difference to climate causes, but subsequent events modified my opinion in that direction. A cold winter followed by a late nesting led to the former belief, but a still colder winter and an earlier nesting upset my theory on that proposition. March 1, 1889, the young were already in the nests. February 28, 1886, my notes show two nests of three eggs each. March 28, 1887, is my first record. Although I had watched diligently for weeks and found many finished nests. March 3 opened the season for 1888 and March 15 for 1889, although the season was not fairly under way till two weeks later. The season of 1887 was characterized by the smallness of the clutches, two eggs as a rule being the maximum number laid, that of 1889 being marked by the other extreme, the complement being seldom less than three but more generally four. Although the season of 1888 opened early in March it was not until March 12 that I visited the principal cactus belts within a radius of about twelve miles east and south of Tucson, and of the fifteen nests examined one contained two eggs; two, three eggs each; five, two young each, and two contained one young each. Three nests were apparently ready for eggs and two were in course of construction. The young in two nests were apparently ten days old and from that age they graduated down to the chipped shell. On the 18th I worked the cactus north of Tucson. I found one nest with two well developed young, one ready for eggs, one with one young fledged and sitting in the bush, two with three eggs each and one with one young, one about a week old. March 25 I partially covered the ground that I had been over on the 12th east of Fort Lowell, following down the Rillito a dry wash and a roaring torrent at different seasons of the year. The young had almost invariably left their nests and were sitting in the bush or running around with the old ones. The broods varied in size from one to three. The season of 1889 did not fairly open till the first week in April, when it opened with a rush, the birds being more numerous and clutches larger than on preceding years. April 3, I noted nine nests containing three eggs each; April 10, five of three; April 13, nine of four, twelve of three and two of two eggs each; April 14, two of four and eleven of three each; April 16, four of four; 17th, three of four and eleven of three; 27th, six of four and eight of three; 30th,

six of three and one of two. This practically closes the book for the year. It must be borne in mind, however, that the foregoing is given only to show the unusual size of the clutches and not as an actual representation of all the nests that came under my observation. The mesas and desert lands of Arizona are better than the macadamized road of the Eastern States for good driving, and, as they are generally level and everywhere accessible to a team, a large area of ground can be covered in one day. This fact partially accounts for the richness of the foregoing result for 1889.

## NOTES ON SOME SPECIES OF THE GENUS ŒNOTHERA.

BY ALICE EASTWOOD.

*Œnothera biennis* L. The flowers of this common species expand about sunrise, not all at once as if they were opened by electricity, but one here, another there, and so on until all the fully developed buds are out. The style is shorter than the filaments, and fertilization takes place in the bud. On a cloudy morning they remain bright and fresh, but when the sun beats down with intense and undimmed rays, the petals are wilted long before noon. The var. *grandiflora* Lindl. has much larger flowers and stems less leafy. The style is larger than the filaments and before the bud opens is protruded from the expanding corolla, so fertilization in the bud is impossible. I have not observed insects flying around the open flowers or crawling within the corollas.

*Œnothera pinnatifida* Nutt. In the spring two classes of plants can be found; those that have evidently lived through the previous season and small plants that appear to be seedlings. The former soon become large with spreading habit, often forming a mat more than a foot in diameter. I have counted sixty-five large white blossoms on a single plant. They die when the seed ripens, unless growing near where the supply of water is permanent, when they appear to become perennial. They bloom in April and May, often lingering on through June and even occasionally into August. When there are rains in August, as there almost always are, a new crop of seedlings comes up which form simple-stemmed plants with a few flowers that remain until the frost. These plants are, in my opinion, the originals of the many stemmed plants of the next spring,

while the spring seedlings come from seeds that did not germinate the previous season, or perhaps from seeds ripened on the fall seedlings. These flowers open about sunset and are not fertilized in the bud, for the pistil greatly surpasses the stamens. I have examined hundreds of pods and have always found two rows of seeds in each cell, eight rows in all. The seeds are round and pitted.

*Œnothera trichocalyx* Nutt. Of this I have collected several forms that vary with reference to the bud, the appearance of which seems to be the chief difference between this and *Œ. albicaulis.* I cannot determine to which species several belong, though the Grand Junction *Œ. trichocalyx* and the Denver *Œ. albicaulis* seem quite distinct. They all have lance-linear seeds, grooved where they press against their companions, and often mottled with red. I found the mottled seeds on the Grand Junction form of *Œ. trichocalyx* and the Denver form of *Œ. albicaulis.* In both, the seeds of well developed pods have two rows in each cell. The plants from Grand Junction have buds that are conspicuously white villous and decidedly blunt; the tips are not in the least free. This seems to be the typical form, as I said before, of *Œ. trichocalyx.*

The form from Thompson's Springs, a station on the Rio Grande Western in Utah, has villous buds that are acuminate but without free tips. I have the same from along McElmo Creek, in southwestern Colorado. The form from Moab in Utah has smooth buds, acuminate and with free tips. The form from Court House Wash, on the road to Moab, has buds slightly villous, with tips acuminate and partially free. These forms are all annuals or biennials.

The Denver form of *Œ. albicaulis* has sparingly villous pods, acuminate and with free tips. It would appear that a specific difference between these two must be sought in some other organ. *Œnothera albicaulis* is distinctively a perennial, but that might arise from its situation. It is always found not far from water, while *Œ. trichocalyx* inhabits desert regions.

In comparing the Denver *Œ. albicaulis* with the forms of *Œ. trichocalyx* I find the leaves to be quite dissimilar, the former having leaves that are either sparingly or deeply toothed and canescent with appressed hairs; the latter having pinnately divided smooth leaves with the segments narrow and linear. However, in looking over Watson's Revision, I find that var. *runcinata* and var. *Californica* of *Œ. albicaulis* have pinnatifid leaves; so the difference in the

leaves ought to have no weight. They both have white shreddy stems, *Œ. trichocalyx* being more frequently red than white. The flowers and capsules do not differ sufficiently to be marked. From all these considerations I feel compelled to believe that there is but one species instead of two. I have not had opportunities to observe the habits of any of these forms, but all are white-flowered and of course open in the evening.

*Œnothera coronopifolia* Torr. & Gray. Next to *Œ. biennis*, this seems most widely distributed. The flowers have a strong, sickening odor, and open before sunset. The style which is at first erect and longer than the stamens becomes declined as in *Epilobium spicatum*. It is not fertilized in the bud. The flowers remain open until nearly noon the next day and seem to gradually wither, changing from white to rose color. They are not quite an inch in diameter, and often there are several in bloom at once on the low but erect stem. There are two rows of seeds in each cell as in those of *Œ. pinnatifida*.

*Œnothera cæspitosa* Nutt., is the most variable of all the species, especially in its manner of growth, seeming to change so as to adapt itself to different conditions, or rather those that became best adapted prevailed and transmitted their qualities to the new generations. The form from Steamboat Springs in Routt county, Colorado, has pods on peduncles from a half-inch to an inch long. It is cæspitose. I have not seen the flower. The Mancos form is cæspitose from running root-stocks, with slightly angled sessile pods. The petals are deeply obcordate. At Grand Junction there are three forms: first, the typical cæspitose form; second, that with simple erect stem, the flowers in the axils and the dry stem of winter thickly covered with large ridged-winged sessile pods; and third, the intermediate, with stems branching from the base above ground, instead of underground, as in the Mancos form. The first is the common mountain form, the second is found at Pueblo and near Colorado Springs in the same kind of adobe soil in which it lives at Grand Junction. The axis of the two last forms is succulent, and doubtless holds a supply of moisture to ripen the fruit during the dry season that always follows the spring rains. The capsules are strongly winged and sessile. The flowers of this species are not fertilized in the bud. I watched the Mancos form and found that the flowers expanded almost at sunset, quite gradually but notice-

ably. The pistil was erect and protruded its viscid stigmas from the opening bud without a grain of pollen to be seen. The stigma lobes which were folded in the bud expanded as the corolla unfolded. Humming bird moths frequented the patches and flew from flower to flower almost as soon as they were open. The flowers were withered before noon the next day. They have a fragrance sweet and strong, so much like a lily that they are often so called. I suppose that the color too has something to do with the incorrect name.

One morning in June, after a frost the preceding night, I perceived, as I was riding along, an open flower with the lobes of the stigma closed. I had never noticed such a phenomenon before, and it impressed me as singular. I wondered if the frost had closed them after expansion or if the cold had prevented their opening. Did the stigma lobes come together to protect the naked stigmatic surfaces, or was it merely an accident?

*Œnothera scapoidea* Nutt., has two distinct forms which are both found at Grand Junction, sometimes even growing side by side. The small-flowered form blooms earlier than the other. The difference in size is marked, one having flowers an inch in diameter with protruding stigmas, the other with corollas less than a quarter of an inch across and stigmas included and fertilized in the bud. The pods and seed differ only in size but to a less degree than the flowers. Both have the red spots at the base of the petals and both have variable leaves. Generally they are entire, sometimes they have a few short irregular lobes at the base of the blade, and rarely have I seen them with margins irregularly sinuate toothed.

*Œnothera cardiophylla* Torr. Approaches so near to *Œ. scapoidea* that it is impossible for me to discriminate among the several forms which I collected this spring. The Grand Junction form has stems leafy along the branches instead of at the base; the leaves are oblanceolate, sinuate, dentate or entire, often with small irregular lobes below the blade. The flowers are very small and reddish, orange when they first open. The Moab form has all the leaves, except the bract-like upper ones, clustered near the root; the upper leaves are small, ovate and remotely dentate, the lower have from one to five pairs of small irregular leaflets on the long petiole. The pedicels equal the pod, but they vary in length in almost every plant. Another Moab form has all the leaves clustered at the base

of the stem, very villous canescent and similar in shape to the preceding form. In its general appearance it comes very near to *Œ. scapoidea*, and I regard it as an intermediate form. In Montezuma Cañon I found a similar plant. The pods are long and slender, twice as long as the pedicels.

I cannot find a constant characteristic among all these forms, but yet the forms that seem typical are not alike. All of the varieties of the (two?) species have two rows of seeds in each cell of the ovary. The impress of the eight rows can be distinctly seen on the pods of all my specimens.

There is an interesting feature common to the two forms of *Œ. biennis* and the two of *Œ. scapoidea*. Each has a large and small flowered variety, the former fertilized after opening and the latter in the bud. It is a subject for future study, and observations have not yet been sufficiently close and extended for theories or hypotheses.

## NOTES ON SOME CALIFORNIAN CISTELIDÆ.

BY F. E. BLAISDELL.

*Stenochidus gracilis* Lec. Sparsely distributed throughout San Diego County. Frequents the blossom of *Adenostoma fasciculatum;* taken in net while at rest from various species of plants. The insect is black in color with basal portions of femora red.

*Stenochidus cyanescens* Lec. One specimen taken in May at Mokelumne Hill, Calaveras County. The genus is not exclusively Californian (*vide* Classif. N. A. Coleop., p. 390), as supposed by Drs. LeConte and Horn—it also occurs in Nevada (Casey). A black species; frequently the elytra have a bluish tinge.

*Hymenorus inquilinus* Casey. One specimen which I refer to the present species was taken from an agricultural ants' nest Sept. 24th, at Mokelumne Hill. The elytra are without impressed striæ, although the sutural lines are partly discernible. Color rufo-testaceous, humeral areas paler. Eyes black, front strongly convex, sparsely punctate and shining, epistoma abruptly flat and rather closely punctured. Prothorax short and slightly wider than elytra, the latter with sides straight and nearly parallel.

*Hymenorus fusculus* Casey. A number of specimens of this species were taken from a pile of decaying sunflower blossoms at Coronado.

*Hymenorus macer* Casey. Common at Poway, San Diego County, under debris, beneath trees and about decaying vegetables.

*Isomira variabilis* Horn. Moderately common at Poway during June and July on the blossoms of *Adenostoma fasciculatum.*

*Cistela Thevenetii* Horn. Moderately rare at Poway. Frequents the blossoms of *Adenostoma fasciculatum.* Color piceous-black to black, femora red.

## LETTER FROM M. ALPHONSE DE CANDOLLE TO M. ERNEST MALINVAUD.*

GENEVA, July 6, 1892.

*Dear Sir and Fellow Member:*

You wish to know my opinion regarding the propositions issued by a committee of very competent botanists in Berlin, on the subject of nomenclature. I have signed the four articles which they propose, and I will tell you why.

In 1867, when we revised the collection of laws of nomenclature, we made omissions and committed several errors, which the march of science has now made obvious. We then thought almost exclusively of the future, scarcely at all of the first epoch in binominal nomenclature. We particularly said that it should start from Linnæus, without explaining from which of his works. But between the first edition of the Systema Naturæ (1735) and the author's last dissertation, published in 1776, a period of forty-one years elapsed, and during this long time his principal works were spread abroad (Genera, Species, Mantissa, etc.). At the same time descriptions of genera and species were published which are or are not sound, according as the nomenclature is based on this or that work of the master.

It is sufficient to cast a glance at the first folio edition of the Systema, now very rare, to be convinced that it is intended to make known Linnæus' twenty-four classes and not at all to define genera. It was in 1737, in the first edition of the Genera, that the author named and characterized the genera which he admitted. In 1753, in the first edition of the Species, he enumerated species under the binominal form. Not long since I was disposed to determine gen-

* Translated by Mary F. McRoberts, from the Bulletin of the Botanical Society of France, Vol. 39, meeting of July 8, 1892.

era from 1737 and species from 1753, but on this point the members of the committee of Berlin make a remark which is, in my opinion, very just. The real merit of Linnæus is to have combined for all plants the generic name with the specific term, which he did in 1753. That is, therefore, the chief date of the new nomenclature. Linnæus did not invent the designating of a species by two words. That is found in many books before his time. But it was an exceptional case, the greater number of species being named by phrases. If this plan had been continued the science would not have changed; there would only have been phrases, more or less lengthy, according as new species were discovered. Happily, Linnæus struck a successful blow when he instituted the constant and general employment of the binominal method as a fixed rule. Thus he is virtually the creator of this method, just as Ant. L. de Jussieu is of naming families, although many before him named and characterized these groups. Taking everything into consideration, it is a happy conclusion, that of deciding upon the date 1753 as the origin of modern nomenclature. That resolves the difficulty regarding the change of names, which the law of priority would entail had an earlier date been fixed upon. Strictly taken, 1752 decides the genera and 1753 the species, but taking into consideration the page which precedes the definition of species in the first edition of Species Plantarum, we see that Linnæus made use of the fourth edition of Genera Plantarum for determination of the genera, which he published in 1752.

The second proposition of the Berlin committee is in part our Article 46 of the Laws of Nomenclature, with useful additions regarding seminuda names, also regarding plates unprovided with descriptions of new genera. The third proposition conforms to the principle of the desirability of fixity of names. Finally, proposition four is a learned and impartial application of exceptions which it is possible to admit in the law of priority. Botanists will be pleased to see the desire to preserve such names as Oxytropis, Desmodium, Statice, Protea, Banksia, Myristica, Dendrobium and others, which an ill-chosen date or irrational interpretation of the law of priority threatened to change. The idea of making exceptions to that rule is not precisely a new one. Our Laws of Nomenclature (Article 4, and Commentary, p. 33) allow this to be seen. Thus the most just and best drafted laws, even in the civil code, are sometimes submitted to alterations which it is true ought to be rare and only caused

by necessity. At the present moment M. Kuntze's much to be regretted work involves just such a necessity. The Berlin committee understand this, and in the list of names to be rejected and names to be preserved, in spite of the law of priority, it has accomplished a difficult task, for which gratitude is due to it. Its propositions are a development of our laws of nomenclature, such as should be made when abuses crop in or when negligence is discovered in the compilation of 1867. I have myself given utterance to ideas of that nature, from which I hope good results, although the action of an isolated individual must always be slower than that of a committee.

Accept, dear sir and fellow member, the assurance of my cordial esteem. ALPH. DE CANDOLLE.

## NOTES ON TWO MEXICAN SPECIES OF CEROPLASTES, WITH A RECORD OF PARASITES REARED FROM ONE.

BY C. H. TYLER TOWNSEND.

The two scales below mentioned have been sent to me by Dr. Alfredo Dugès, from the vicinity of Guanajuato, Mexico. To Dr. Dugès also is due the credit for the information given regarding food-plants.

*Ceroplastes dugesii* J. Licht.—Found at Guanajuato "more commonly on *Malvaviscus arboreus* Cav. and *M. acerifolius* Presl., two shrubs of about 3 or 4 metres height; and *accidentally* on adjoining shrubs." This is a large species, nearly white, sub-hemispherical, showing no division into plates, the white waxy secretion being very susceptible to pressure and filled with a watery liquid. Specimens kept dry for months do not lose this liquid in the least degree. Those sent measure in length, 9 to 11 mm.; width, 7 to 9 mm.; height, 5 to 8 mm.

*Ceroplastes* sp.—Found "on *Bignonia (buccinatoria?)*, and *Chrysanthemum* at Guanajuato." This is quite a different species in appearance. It considerably resembles *C. cirripediformis*, but is more than twice as large. The waxy secretion is not so white as in *C. dugesii*, but more of a dirty gray in color, not so soft, dryer, and is very distinctly marked off into plates, much resembling in general form the carapace of the box-turtle *(Cistudo)*. There is a dorsal, central, rounded plate, with a central black navel-like

spot; around this are grouped six other plates, two on each side and one at each end, the anterior end plate being the widest and bearing in a transverse row three central navel-like spots, the other plates sub-equal and with a single navel-like spot approximated to lower lateral margin; all the plates are marked with numerous very slight ridges radiating from the navel-like spot, the radiations being perfect on all sides from the center of the dorsal plate, and mostly upward and laterally on the others, the anterior end plate most approaching the central one in this respect. The specimens sent measure in length, 6 to 8 mm.; width, 4½ to 5½ mm.; height, 4 to 6 mm.

The specimens of this species were received from Dr. Dugès, on Sept. 27. On opening them, there were found to be present numbers of live adult flies of some species of parasitic microhymenoptera. Probably a dozen or more of these parasites escaped at this time. These all belonged to the more numerous flavous species. More of the same issued up to Sept. 29. The scales were not again looked at until Oct. 15, when a careful examination showed four different forms among the parasites, some of which had been issuing up to date. These were counted, showing the following numbers that had issued from 10 scales: The more numerous were the first or common flavous form, distinguished by the scutum of thorax being of a rufous tinge, and of which there were 22 specimens. Of a smaller form, which was black above and pallid below, there were 6 specimens. There were 3 specimens of a form more slender than the first one, and perfectly black except the wings. And finally there was a single specimen of a beautiful trypetid-like variegated-winged species, having the wings white with fuscous reticulations and the body marked in very much the same way. The flavous form was the only one noticed for the first few days, and the others must have issued much later. One specimen of the black species was found alive Oct. 15.

These parasites were sent to Mr. L. O. Howard for determination, and the following letter was received in reply:

"I am glad to get the specimens which you send, and it is interesting to know that all are bred from *Ceroplastes*. The yellow species, which occurs in the greatest abundance, is a species of *Aphycus*. It differs, curiously enough, from my *Aphycus ceroplastis* described in Bulletin 5 of this Division, and which was bred from

a *Ceroplastes* received from Silver City, N. M. I fully expected that your form would prove identical with this. The beautiful species which resembles a *Trypeta* belongs to a new genus of *Encyrtinæ*. We have the same species in the National Collection from California. The other species—the small black one—belongs to the genus *Tebrastichus*, and is a parasite not of the scale-insect, but of the *Aphycus*. It is a tremendous genus and the species are not worked up."

## A SUPPOSED NEW FEATHER STRUCTURE:

BY CHARLES A. KEELER.

In examining a specimen of the Arizona hooded oriole *(Icterus cucullatus nelsonii)*, I observed what looked like fine black hairs sticking out among the feathers on the head and back of the neck. Upon extracting one of them, and examining it under the microscope it had every appearance of being a true hair. In reality it is probably a structure allied to the rictal bristles, but occurring in so unusual a place, and lying down upon the feathers instead of standing erect it has the appearance of being a different structure. Being unable to find any allusion to it I would propose, if it be indeed a new structure, that it be termed PSEUDOPILUM. They are present on the backs of the neck and heads of all the orioles I have been able to examine, and might prove to be a generic character. They also occur in both sexes and in the young, although most numerous in the adult male.

## ON NUMENIUS BOREALIS IN CALIFORNIA

BY L. BELDING.

I think *Numenius borealis* published by Mr. Holterhoff in The Auk (vol. i, 4, 393), and referred to by Mr. Bryant (Zoe iii, 2, 165), was really *N. hudsonicus* and Mr. Holterhoff was mistaken in identifying his specimen. I was in San Diego not long after he published the note of its occurrence there and asked to see the specimen. He showed me a specimen of *N. hudsonicus* instead of *N. borealis*, and as there is no other known record of its capture in California, it is scarcely entitled yet to a place among Californian birds.

# NOMENCLATURE OF PLANTS.

BY KATHARINE BRANDEGEE.

The Botanical Club of the American Association for the advancement of Science, which met this year on August 18, at Rochester, N. Y., appointed, on motion of N. L. Britton, a committee to consider the question of nomenclature and submit a set of recommendations to the club. The committee as appointed consisted of N. L. Britton, John M. Coulter, H. H. Rusby, W. A. Kellerman, F. V. Coville, L. M. Underwood and L. F. Ward, and on the following day submitted this report:

Resolved, That the Paris Code of 1867 be adopted, except where it conflicts with the following recommendations:

I. *The Law of Priority.*—Priority of publication is to be regarded as the fundamental principle of botanical nomenclature.

II. *Beginning of Botanical Nomenclature.*—The botanical nomenclature of both genera and species is to begin with the publication of the first edition of Linnæus' *Species Plantarum* in 1753.

III. *Stability of Specific Names.*—In the transfer of a species to a genus other than the one under which it was first published, the original specific name is to be retained, unless it is identical with the generic name or with a specific name previously used in that genus.

IV. *Homonyms.*—The publication of a generic name or a binomial invalidates the use of the same name for any subsequently published genus or species respectively.

V. *Publication of Genera.*—Publication of a genus consists* (1) in the distribution of a printed description of the genus named; (2) in the publication of the name of the genus and the citation of one or more previously published species as examples or types of the genus, with or without a diagnosis.

VI. *Publication of Species.*—Publication of a species consists* (1) in the distribution of a printed description of the species named; (2) in the publishing of a binomial, with reference to a previously published species as a type.

VII. *Similar Generic Names.*—Similar generic names are not to be rejected on account of slight differences, except in the spelling of the same word; for example, *Apios* and *Apium* are to be re-

* Amended Aug. 22, by inserting the word "only."

tained, but of *Epidendrum* and *Epidendron*, *Asterocarpus* and *Astrocarpus* the later is to be rejected.

VIII. *Citation of Authorities.*—In the case of a species which has been transferred from one genus to another, the original author must always be cited in parenthesis, followed by the author of the new binomial.

The main discussion upon this report was on Article VI, in regard to the acceptance of named exsiccati not accompanied by a description as valid publication of a species, which was discussed by Messrs. Beal, Coulter, Vasey, Swingle, Bailey, Kellerman, Barnes, Fernow, Cook, Dudley, Morong, Britton, Underwood and Johnson. The motion to amend by including exsiccati was lost.

Dr. Britton moved that a permanent committee be appointed to serve as a board of arbitration, and to prepare and print a list of the flowering plants within the area of the sixth edition of Gray's Manual in accordance with the recent report on nomenclature. It was subsequently agreed to to extend the range to include Canada, Nebraska and Kansas. On motion of Dr. Arthur the nomenclature committee was made the permanent committee for this purpose. A further motion was carried "that this committee be empowered to receive all suggestions and criticisms of this list, and to report upon them at the next year's meeting."

The action here taken is certain to have an important effect upon botanical nomenclature, in North America at least, as most botanists would be willing to make concessions in non-essentials for the sake of peace and uniformity. It is evident that such sacrifices were made in committee, as Art. IV of the principles set forth in the circular† sent out to American botanists did not appear in the report. This article, which received the signatures of four members of the committee, provided "That a varietal name be treated as equal in rank to a specific name, in its relations as a homonym and in the transfer of species and varieties from one genus to another."

The effect of this article would be to render the oldest specific name invalid in place of a still older varietal name. We have to thank the good sense of the committee for the shelving of this article, which would necessitate an absurdity in citation, and in view of the extreme looseness with which varieties are treated in bot-

† Zoe, iii, 170.

any—as equivalent to subspecies on one hand and to the slightest variation on the other—would lead to endless confusion.

Articles I, III, V, VI, VII, VIII will continue to be the practice, as they have been in the past, of most botanists.

Objections to Article II may readily be waived.

If Article V is rigidly enforced we shall be delivered from a lot of Rafinesquian trash—Agoseris for instance, where no type species is named.

The discussion on Article VI is somewhat surprising, as it is evident that some members of the club wished to make the issuance of exsiccati a valid publication. It might be endurable to so consider sets carefully prepared under competent superintendence and sufficiently numerous to allow at least one to each country, but a moment's reflection ought to convince anyone that sets as ordinarily distributed—in which only the sample, if any, has been submitted to authority—would be valueless for such a purpose, while the facilities for species-making, already too great, would be immensely increased.

And who should have authority to discriminate?

Article VIII, requiring the name of the original describer of a species to follow it in all cases, and in parenthesis when transferred to another genus, seems to us a great improvement over the old practice, which made no distinction between species described by an author and those merely, for any reason, written after another generic name—indeed offered a premium for as many changes as possible. The concluding clause, requiring the name of author of the last transference to be appended after the parenthesis, will probably be followed or neglected according to the fancy of the writer, as at present.

The rock ahead in these rules is the fourth article: the "Once a synonym always a synonym" provision. If this were intended as a rule for future guidance the objections might easily be overcome, though it would enable any mean-minded man—and some such have been known in botany—to prevent the commemoration of the name of anyone against whom he might have a grudge, by attaching his name to an invalid genus; but as a retroactive measure it will make chaos come again, unless—which it is idle to hope for—it could be left to the hands of careful monographers, It appears to us far better to let the matter of homonyms rest and devote the time spent

in discussions of them to a study of the organisms themselves, especially as such study may result in altering the bounds of genera and involving a new set of names, for perhaps few botanists, if they remember the mutations of genera in the last hundred years, largely due to our increasing knowledge, will consider that even their own efforts will be able to put nomenclature on a perfectly stable footing.

The annoyance arising from homonyms in synonymy is comparatively small, but as between zoology and botany they are a crying evil which overshadows all the others. Even so long ago as 1846, when Agassiz wrote the index to his Nomenclator Zoologicus he made the statement that the rectification of these names in zoology and as between zoology and botany would necessitate the sacrifice of almost half the generic names made in recent times, and it must be apparent to anyone that the inconvenience of writing concerning an insect feeding upon a plant of the same name is infinitely greater than that arising from the occasional revival of an old homonym, especially as by the recent tendency of science genera are more apt to be consolidated than divided.

The law of priority is apparently the only way of securing uniformity, yet it is repugnant to our sense of justice to reckon as of equal value in systematic science the work of careful and conscientious botanists and of the other far too numerous ones who, without herbaria or books of reference, record their vague descriptions, often identifiable only by the process of exclusion, in obscure journals or trade catalogues. There is no other branch of human knowledge which deliberately encourages incompetence.

We pay a dear price for uniformity when we have to accept such work as that of Necker and Rafinesque, and to dread the day when some Mexican may take it into his head to identify the plants of Hernandez' Historia Plantarum Novæ Hispaniæ, and give us some hundreds of names like *Tzonpilihuizpatli Tepuzculullæ*, for instance.

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A CORRECTION.—I included in the additions to True's Checklist (in this issue) a reference to Am. Rept. Dept. Agr. 1887, p. 435, as the place where the name *Sorex richardsonii* was revived. This is a mistake as *S. richardsonii* was revived, so far as I know, in Merriam's Geog. Dist. of Life in N. Am. (Proc. Biol. Soc. Wash. vii, April 13, 1892, p. 25.) The species referred to in Annual Report for 1887 is *S. Forsteri*, which should not appear in the list of additions as it is given in True's list. T.S.P.

# INSECTS OF CATALINA ISLAND.

BY F. A. SEAVEY.

During the last week in August of the present year I spent part of the time in collecting insects on Catalina Island. As I know of no list of insects from this island having ever been published, I send one of my collection, incomplete as it is, trusting it might be of some interest in furnishing a new locality for the insects named:

## HYMENOPTERA.

*Apis mellifica* Linn.
*Emphor* sp.?
*Bombus Californicus* Smith.
*Bombus* sp.?
*Pompilus ferrugineus* Say.
*Pompilus tenebrosus* Cresson.
*Pompilus* sp.?
*Parapompilus* sp.?
*Augochlora pura* Say.
*Polistes aurifer* Saussure.
*Ceratina acantha* Provancher.
*Paratiphia albilabris* Spinola.
*Philanthus Californicus* Cresson.
*Vespa diabolica* Saussure.
*Bembex fasciata* Fabricius.
*Bembex nubilipennis* Cresson.
*Isodontia* sp.?
*Sphærophthalma* sp.?
*Sphærophthalma aureola* Cresson.
*Dipara* sp.?

## COLEOPTERA.

*Balaninus obtusus* Blanchard.
*Anthonomus canus* LeConte.
*Pristoscelis quadricollis* LeConte. From *Heteromeles arbutifolia.*
*Carpophilus pallipennis* Say.
*Saprinus vitiosus* LeConte.
*Platynus brunneomarginatus* Mannerheim.
*Tropisternus Californicus* LeConte.
*Hyperaspis lateralis* Mulsant. From *Artemisia Californica.*

*Psyllobora tædata* Leconte. From *Artemisia Califoinica.*
*Chilocorus bivulnerus* Mulsant.
*Hippodamia ambigua* LeConte.
*Hippodamia convergens* Guerin.
*Coccinella sanguinea* Linnæus.
*Diabrotica soror* LeConte.

## HEMIPTERA.

*Lygæus reclivatus* Say.
*Lygæus* sp.? From *Verbena prostata.*
*Orsillus scolopax* Say. From *Verbena prostata.*
*Nysius angustatus* Uhler. From *Verbena prostata.*
*Narnia femorata* Stal.
*Neathus vitripenne* Stal.
*Murgantia histrionica* Hahn. From *Isomeris arborea.*
*Platycotis* sp.?
*Kermes galliformis* Riley.
*Lecanium oleæ* Bernard.
*Lecanium* sp.?
*Aspidiotus convexus* Comstock.

## DIPTERA.

*Volucella avida* Osten Sacken.
*Volucella esuriens* Fabricius.
*Volucella tau* Bigot.
*Copestylum marginatum* Say.
*Anthrax edititia* Say.
*Anthrax pretiosa* Coquillett.
*Anthrax sinuosa* Wiedemann.
*Lepidanthrax inaurata* Coquillett.
*Nerius* sp.?
*Ectyphus* sp.?

## ORTHOPTERA.

*Scudderia Behrensii* Bruner.
*Œcanthus* sp.?
*Labia* sp.?

## NEUROPTERA.

*Chrysopa* sp.?

# RECENT LITERATURE.

## Reviews of Paleobotanical Literature.

BY THEO. HOLM.

A. G. Nathorst: *On the occurrence of fossil glacial-plants.**

It is nothing less than a mapping of the former distribution of the Arctic flora in Europe, that the author presents in these papers. They are principally based upon his own observations, and contain an invaluable account of the distribution of these plants. The accompanying map gives a comprehensive view of the former extent of the Ice-period in Europe. covering an area from 50° to 70° lat., besides Switzerland, a part of Hungary, Bavaria, Würtemberg, France and the Pyrenees.

The plants which especially indicate the presence of a former Arctic flora are: *Salix polaris*, *S. reticulata*, *Betula nana*, *Polygonum viviparum*, *Azalea procumbens*, *Saxifraga oppositifolia*, *Dryas octopetala*, besides some others, including mosses. The author presumes that several other species of *Salix* will be found by closer examination of the considerable material he has at hand, as there are some leaves which very much resemble *S. myrsinites*, *S. myrtilloides*, *S. retusa*, *S. Lapponum* and various others.

The fragments of these plants are not only leaves, but also branches, catkins and fruits. It will be interesting to know the conclusions which the author promises will soon appear from these investigations, concerning the former and present distribution of the Arctic plants. Some very interesting points have been given, however, in the present paper, concerning the distribution of *Dryas*. For the first time this has lately been discovered as fossil in Great Britain in a single locality near Edinburgh, while it is found in the living state among the mountains of Wales, Yorkshire and Scotland. *Polygonum viviparum* was found as fossil in Switzerland, but no fossil remains have ever been found of it in Sweden, although it is very common in the recent flora.

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*"Ueber den gegenwärtigen Standpunkt unserer Kenntniss von dem Vorkommen fossiler Glacialpflanzen." (Bihang K. Sv. Vet. Akad. Hdlgr. vol. 17, 1892; Stockholm, pp. 1–32, with map.) and: "Den arktiska Florans forna Utbredning i Länderna öster och söder om Oestergön." (Ymer, Stockholm, 1891, pp. 115–147, with map.) Also, "Fresh Evidences Concerning the Distribution of Arctic Plant during the Glacial Epoch." (Nature, vol. 45, Jan., 1892.)

The accompanying map shows, also, the former and recent distribution of *Salix polaris*, which, in connection with the other facts mentioned above, may give us important hints as to the migration of plants. It is to be hoped that Professor Nathorst will soon give us the promised work upon the distribution of these plants. And similar researches are highly recommended to the paleobotanists of this country.

FRIDOLIN KRASSER: *The Rhetic flora of Persia.**

It was not until the year 1858 that the fossil flora of Persia was investigated, when Dr. Goebel, as a member of the Khanikow-expedition to Chorassan, had the opportunity of making some collections in that country. These were studied by Dr. Goeppert. While Dr. Goebel collected in the province Asterabad in eastern Persia, visited Tietze, several years later, Hif near Kaswin and the mountain Siodscher, and Dr. Wähner made extensive collections on the Polak-expedition, discovering plant-bearing deposits near Rudbar and Sapuhin.

The Persian fossils from these localities occurred in a formation consisting principally of a greenish or sometimes reddish sandstone, the age of which, judging from the flora, seems to be identical with the Rhetic formation.

The author gives a complete list of works, published upon this Persian flora, the most important having been written by Goeppert, Polak, Schenk, Sturr and Tietze. He also mentions the most interesting fossil plants that were collected by the above mentioned explorers, and gives, finally, a full account of a very large collection, made recently by Dr. Rodler near Sapuhin at Kaswin, and presented to the Vienna Museum by the late Dr. Polak, court-surgeon of the Shah. It is especially from this last collection, that the age of the formation has been ascertained, and the specimens seem to give a more complete illustration of that flora, than any of the other Persian collections. We find in the list a few *Archegoniata: Equisetaceæ* and *Filices*. Among the genera of these families are *Equisetum*, *Phyllotheca*, *Asplenium*, *Bernouillia*, *Clathropteris* and others. The *Cycadeæ* are represented by *Podozamites*, *Otozamites*—of which *O. Polakii* is described as new to the science—and such genera as

*"Ueber die fossile Flora der rhätischen Schichten Persiens." (Sitzungsberichte d. K. Akad. d. Wissenschaften, Wien. vol. 100, 1891, 20 p.)

*Pterophyllum* and *Anomozamites*. Among the *Coniferæ* are found *Palissya*, *Baiera* and *Ginkgo*.

H. ENGELHARDT: *Cretaceous plants from Saxony*.*

Such authors as Brongniart, Sternberg, Brown, Geinitz and Goeppert have already described the cretaceous Ferns, Cycads and Conifers from the locality near Freiberg, in Saxony, and Ettingshausen has treated the oldest dicotyledonous plants of the region in his paper: "Die Kreideflora von Niederschöna in Sachsen."† But since the year 1867, nothing of importance has appeared upon this subject. There is, however, in the Museum of the "Freiberg Bergakademie" a considerable collection made by Reich, which has been left partly unnamed, and it is upon this valuable material that the author has based the present paper. It contains an enumeration of plants with several critical remarks, and following are figured and described as new species: *Pterophyllum Reichianum (Cycadeæ)*, *Salix Schoenæ*, *Triplaris cenomanica (Polygoneæ)*, *Sapotacites Stelzneri*, *Mimusops ballotæoides*, *Chrysophyllum Velenovskyi*, *Sapindus saxonicus*, *Sterculia Geinitzi*, *Simaba saxonica* and *Leguminosites cretaceus*. The collection embraces, also, several very interesting types, and, although described before, we will note the presence of such characteristic forms as: *Delesseria Reichii*, *Didymosorus comptoniæfolius*, *Sequoia Reichenbachii* and *S. minor*, *Diospyros primæva* and *Liriodendron Meekii*.

C. T. BARTHOLIN: *Jurassic plants from Denmark*.‡

The present paper contains an enumeration of fossil plants, mostly collected by the author himself during his stay on the Danish island Bornholm. They all belong to the Jurassic flora, and represent the *Equisetaceæ*, *Marsiliaceæ* and *Filices*.

*Sagenopteris Nathorsti* is described and figured as new to the science. The author with some doubt has referred to this genus the fragments of some leaves which, if we consider the minute nervation, resemble somewhat the genus *Antrophyopsis*. There has, also,

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*"Ueber Kreidepflanzen von Niederschöna." (Sitzungsberichte und Abhandlungen d. naturwiss. Gesellschaft Isis. Dresden, 1892, pp. 79–105. One plate.)

†Sitzungsberichte d. K. Akad. d. Wissensch. Wien. vol. 55.

‡"Nogle i den bornholmske Juraformation forekommende Planteforsteninger." (Botanisk Tidsskrift, Kjöbenhavn, 1892, vol. 18, pp. 12–28, plates 5–12.)

been described and figured a new species of *Laccopteris*, but the author has not ventured to name this supposed new species, since merely a very few specimens were discovered. This form seems to be related to *L. elegans*, but differs, however, by the considerably larger size of the leaves and the variation of nervation.

*Hausmannia Forchhammeri* apparently represents a distinct type. It has the appearance of *Jeanpaulia* very much in the shape of the frond, being stipitate and showing some divisions; but, the secondary nerves proceeding at right angles from the primary one, brings this form as to nervation closer to the genus *Clathropteris*.

The author calls attention to the fact that the leaves of *Hausmannia* show the same peculiar difference as does *Platycerium* of the recent. Concerning the arrangement of the sori, this new species agrees with *Clathropteris platyphylla*, in which they are scattered all over the dorsal face of the leaf.

The situation of the sori in relation to the nerves, was, unfortunately, not to be distinguished in the fossil. The plates contain several, well-drawn figures, with some details of all the species which were collected.

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*Third Annual Report of the Missouri Botanic Garden.* The scientific papers are, first, A Revision of the American Species of Rumex occurring North of Mexico, by William Trelease. Twenty-three species are admitted and illustrated by as many plates, which though unecessarily reduced for the size of the page and deficient in detail will be found useful in dealing with this somewhat neglected group. In the second paper Dr. C. V. Riley brings together in accessible form papers previously published on "The Yucca Moth and Yucca Pollination," and describes six new species of Yucca moths *Pronuba synthetica*, *Prodoxus pulverulentus*, *P. y-inversus*, *P. reticulatus*, *P. coloradoensis* and *P. sordidus*. The ten appended plates are devoted to the different moths and details of oviposition and pollination. The paper is of much interest, but the author's argument that the Pronuba deliberately gathers the pollen from one flower and carries it to another with the view of fertilizing the flower and producing food for her young is somewhat of a draft on our capacity for belief.

The succeeding papers are: Notes and Observations on Yucca, with many good photographs and several detail drawings by Engel-

mann; a description of a new species of Agave *(A. Engelmanni* Trel.) and some notes with a plate on *Parmelia molliuscula.*

More than a third of the volume is occupied by reports of the annual banquets of the trustees and gardeners, and the annual flower sermon. Some of our English botannical friends are inclined to poke fun at this feature of the Report, and it must be confessed that a lot of bombastic after-dinner speeches do not combine well with scientific papers, but in fair justice it must be admitted that the authors of the scientific papers should not be held responsible.

K. B.

*The North American Pyrenomycetes.* By J. B. ELLIS and B. M. EVERHART. This book is an octavo of nearly 800 pages, with 41 excellent plates drawn by F. W. Anderson, whose early death we have had recently to deplore. Very little critical work has been done excepting in the Erysipheæ, which were elaborated by Prof. T. J. Burrill. Scarcely any attempt has been made to indicate the conidial and other stages of the species and the specific keys are of the slightest; as for instance in Sphærella, where the sections of the genus are given as:

A. Parasitic on leaves of dicotyledonous trees and shrubs.
B. On leaves and cones of coniferous trees.
C. On stems and leaves of dicotyledonous herbaceous plants.
D. On monocotyledonous plants.
E. On cryptogamous plants.

This may be as good a key as any, where the principal distinctions among the species appear to be the different plants on which they grow, with an occasional variation of a few micromillimetres in size, but this being the case the want of an index of hosts is especially remarkable. The volume on account of the large type and spacing is unduly large, and the plates though excellent are in many cases of species which have already been figured, and render the book too expensive for the masses, while to the specialist it is entirely unnecessary.

K. B.

*Contributions from the U. S. Herbarium*, vol. i, No. 5. This publication contains four papers. The first is a list of the plants collected by Dr. Palmer in 1890 on Carmen Island. *Drymaria diffusa, Desmanthus fruticosus, Passiflora Palmeri, Houstonia fruticosa, Brickellia brachiata* var. *glabrata* and *Euphorbia Carmenensis,*

the first three illustrated by excellent plates which I am glad to see are not folders, are described as new. The second paper—Plants Collected by the U.S.S. Albatross, 1887–91, along the Western Coast of America—is by various authors. J. N. Rose: Plants from Cocos and Galapagos Islands; D. C. Eaton: Ferns and Mosses from Southern Patagonia and Fuegia, with description of one new species *Bryum cœlophyllum;* A. W. Evans: List of Liverworts from Southern Patagonia, with descriptions of two new species, *Lophocolea apiculata* (pl. xv) and *Schistochila quadrifida* (pl. xvi); and a short list of Lichens from the same place by Dr. J. W. Eckfeldt. The third paper is a revision of the North American species of Hoffmanseggia by E. M. Fisher, and though marred somewhat by careless proof-reading is a valuable contribution: The study includes 17 species, two of them, *H. Texensis* and *H. canescens*, described as new and 9 new varieties are also characterized. One species, *H. intricata*, has suffered change of name, the older var. *glabra* being substituted for it, it seems to me, without due consideration. The writer fully agrees with the proposition that varietal names should be retained when a named variety is raised to specific rank—with one important reservation—that in no case is a specific name to be disturbed. For a varietal name can only claim priority as a variety, its specific date being that on which it was described as a species, any other course would involve the nomenclature in a series of false assumptions and absurdities. The author, for instance, finds himself unable to attach Watson's name to a species which he never named, yet inferentially appends his own, which can only date from the publication of his paper. As a matter of fact the name *glabra* was passed over for what appeared to be two good reasons. In the first place it is a pure and simple "nomen nudum," and if it were specific instead of varietal could only hold by the courtesy of a subsequent describer. In the second place Hoffmanseggia belongs to the category of unstable genera, being regarded as too near Cæsalpinia by Bentham, and unhesitatingly reduced to that genus by Baillon, and there is at least one older valid species of Cæsalpinia bearing the specific name *glabra*.

Another instance where the author's nomenclature seems to be at fault, according to his own rule, is in using *demissa* as a varietal name under *H. falcaria*, though by the synonymy given under it *H. densiflora* is the prior name.

The Systematic and Alphabetic Index of New Species, published in 1891, of North American Phanerogams and Pteridophytes, by Josephine A. Clark, which is the last paper, is one that every systematic botanist will find extremely useful, and we hope the other promised publications from the card list of the Botanical Division will soon appear. T. S. B.

*Life Histories of North American Birds with special reference to their Breeding Habits and Eggs, with Twelve Lithographic Plates.* By. CHARLES BENDIRE, U. S. Army (Retired). Smithsonian Institution. U. S. Nat. Mus. Special Bulletin No. 1, 1892, pp. viii, 1–414. Since the publication in 1857 of a single volume of the series begun by Dr. Thomas Mayo Brewer on the nests and eggs of North American birds no similar work has been attempted, if we except Ernest Ingersoll's financially unsatisfactory venture. The need of material both for the text and for figuring typical eggs has been a serious obstacle now removed by the matchless collection of Captain Bendire and the assistance rendered by others by contributions of new and more complete data relating to nidification supplementing the author's own extensive field experience. Doubtless there is no one equally as competent to deal with this subject as Captain Bendire who has, from time to time, in the pages of the Auk, biographically treated of several species in a manner that leaves but little to be desired. The work contains a few typographical, but self-correcting errors of proper names. The style is simple and clear. The text is decidedly not a compilation but remarkable for the amount of new reading that it contains, and one feels a confidence in accepting the facts as facts. The present volume, the first of the series, treats of 146 species and subspecies including the gallinaceous birds, pigeons and birds of prey. The text is not confined to descriptions of nests and eggs, but treats also of the life histories of each species, their geographical range, migration and food habits. The colored lithographic plates representing full sized typical eggs and variations are excellent, having been reproduced by Ketterlinus from the water-color drawings by Mr. John L. Ridgway. W. E. B.

The *Auk* for October has two photogravure plates of nests of the fish hawk accompanying an article on the "Breeding Habits of the Fish Hawk on Plum Island, New York," by Charles Slover Allen.

R. H. Lawrence contributes "Further Notes on Birds of the Gray's Harbor Region, Washington," with annotation on about forty species. "Birds of Southwestern New Mexico," by A. W. Anthony, has brief notices of 127 species and subspecies.

In General Notes, *Ereunetes occidentalis* is recorded from Connecticut; *Cöccyzus americanus occidentalis* from Clarke County, Washington; *Vireo olivaceus* inhabiting British Columbia and Washington. Mr. Lucas makes an interesting item concerning the raising of English sparrows by electric light. This pest having been seen catching insects at night about an electric light and carrying them to their young. "Raising vegetables," he says "by electric light may be a good thing, but raising English sparrows in this manner is of more than doubtful utility." W.E.B.

In the *Scientific Memoirs* of Medical Officers of the Army of India, edited by W. R. Rice, Calcutta, 1892, part vii, we find five different papers on intestinal worms infesting horses, sheep and man. The first paper is by G. M. F. Giles on Some Observations on the Life History of *Sclerostomum tetracanthum* Diessing. This intestinal parasite is a strongyloid nematode closely related to *Dochmius duodenalis*, which infests the human system. *Sclerostomum tetracanthum*, is a small worm about half an inch in length, but as it occurs in enormous quantities—several buckets full having been taken from a single horse—it causes grave disorders and generally death. The disease caused by this parasite is in India known as "Surra," in Europe as epizooty, and appears to be prevalent at times in almost every county in the world.

Sclerostomum infests only the upper half of the large intestine, the ova only being dropped with the dung. The eggs develop only under the influence of rain and moisture, producing a tiny, white and semi-stransparent worm, the Rhabdite-stage of the parasite in question. These Rhabdite worms feed and live in the dung until they become sexually fertile when they proceed to grass and weeds. This transition can only be accomplished under the influence of rain or abundent moisture under any form. The mature male Rhabditis attains a length of 1.7 mm., two-ninths of the length being occupied by the body proper, the remaining seven-ninths consisting of a long hair-like tail. The female Rhabditis attains a length of 2.25 mm., but is otherwise similar to the male. One or more generations are produced by this stage. Finally the ova of the Rhabdite

form gain access to the intestines of herbivorous animals, being swallowed with the green plants on which they feed. The embryos develop rapidly and finally encyst themselves in the walls of the stomach, cœcum and colon, and later on emerge as full grown Sclerostoma. *Dochmius duodenalis*, which is very similar to the Sclerostomes, causes the dreadful disease in man known as "Kala-azar" or "Beri-Beri." The best remedy to be administered are repeated doses of ½ oz. each of Thymol, 1½ oz. in all being sufficient to expel all the free worms, the treatment to be repeated when the cysts have developed.

In a subsequent paper in the same part Mr. Giles describes 3 species of Sclerostomes—*robustum*, *equinum* and *tetracanthum*, all infesting the horse.

Following this paper is one by the same author "On Nodular Disease of the Intestines in Sheep." In Assam and Burma the keeping of sheep is almost impossible on account of this nodular disease, the sheep dying off one by one in quick succession. This disease, also common in United States, is caused by a nematode worm, *Œsophagostoma columbianum* Curtice. The ova are carried away by the dung, hatch out in one or two days and become Rhabdites with short tails. They moult at least three times, and feed on green vegetation. Their eggs pass into the intestines of sheep, encyst there and later develop into Œsophagostomas. No successful treatment is possible and no prevention is likely to succeed. The Rhabdite forms exist continuously as free nemadotes and only await the opportunity to pass into the sheep. Stall feeding with steamed fodder appears to be the only prevention. G. E.

## PROCEEDINGS OF SOCIETIES.

CALIFORNIA ACADEMY OF SCIENCES. *August 1, 1892.* President Harkness in the chair.

Donations to the museum were reported from S. Reubel, W. W. Price, A. W. Anthony, Dr. J. G. Cooper, John Carlsen, Frank H. Vaslit, W. O. L. Crandall, Agent S. P. Co., Indio, Cal., C. W. Knox, Frank H. Holmes, Charles Fuchs, Mr. Goebig, M. Braverman, E. D. Flint, J. W. Barry, Dr. Harkness, Charles A. Keeler, J. J. Kinrade.

The Librarian reported 187 additions to the library.

A paper by William W. Price on the Discovery of a New Grove of *Sequoia gigantea* was read by Walter E. Bryant.

A paper by Dr. J. G. Cooper on Land and Fresh-water Shells of Lower California was read by title.

The Secretary read a paper prepared by Melville Attwood on the advisibility of making an exhibition of Californian iron ores at the World's Columbian Exposition.

Dr. Harkness exhibited a living specimen of Amblystoma and made a few remarks concerning its metamorphosis.

Charles A. Keeler and Prof. W. E. Ritter discussed certain points in Romanes' theory of natural selection.

*September 5, 1892.* President Harkness in the chair.

Donations to the museum were reported from W. G. Blunt, Carlos Troyer, R. G. Stitt, Lieutenant Holcomb, E. W. Jones, Melville Attwood, R. C. McGregor, Miss Effie A. McIllriach, George B. Badger, Sidney M. Smith, Mrs. Nuttall, Mrs. Bush, A. W. Crawford, T. H. Hittell.

Twelve hundred and twenty-six additions to the library were reported.

E. W. Jones, by invitation, addressed the Academy on the subject of tin mining, explaining the methods used at the Temescal mine in working the ore.

Charles Fuchs made some remarks on *Phlœosinus dentatus* Say, which is ravaging the cypress trees.

*September 19, 1892.* President Harkness in the chair.

Donations to the museum were reported from C. H. and Dr. E. S. Clark, Henry Lorenzen, J. B. Haggin, James E. Requa, Carlos Troyer, G. P. Rixford, Mrs. A. E. Bush.

The Librarian reported 207 additions to the library.

Charles A. Keeler read a paper entitled Sexual Selection as a factor in the Beautiful in Nature.

*October 3, 1892.* President Harkness in the chair.

Anthony W. Vogdes and Oscar T. Baron were elected resident members.

Donations to the museum were reported from H. S. Nichols, Miss Effie A. McIllriach, Olaf Olsen, Dr. J. G. Cooper, Dr. L. D. Morse, M. Braverman.

Seventy-six additions to the library were reported.

Major J. W. Powell, Director of the United States Geological Survey, delivered a lecture on the Aboriginal Tribes of North America.

A vote of thanks was tendered to Major Powell.

*October 17, 1892.* President Harkness in the chair.

Additions to the museum were reported from F. A. Marriott, Jr., Mrs. C. A. Boland, Frank Miller, Dr. J. G. Cooper, Capt. Hultman, Geo. E. Twitchell and Thomas C. Johnston.

A vote of thanks was tendered to Mr. Thomas C. Johnston for his donation of a valuable ethnological collection from the South Sea Islands.

The Secretary read an announcement of the discovery by H. W. Fairbanks of *Proetus ellipticus* Meek, a trilobite from the Waverly Group, in Shasta County, California, identified by Captain A. W. Vogdes.

Lieutenant John P. Finley delivered a lecture on Phases of Pacific Coast Weather and Violent Local Storms, illustrated with stereopticon views.

A vote of thanks was tendered Lieutenant Finley.

CALIFORNIA BOTANICAL CLUB. *September 5, 1892.* Dr. Harkness in the chair.

The following were elected to membership: Miss Alice J. Merritt, Mrs. H. W. Hansen, Thomas Hatch, J. W. Blankinship, Dr. Ferdinand A. Hassler, Miss M. B. Harvey, Mrs. M. E. P. McCowen.

*September 29, 1892.* President Campbell in the chair.

Professor Douglas H. Campbell delivered a lecture on a Trip to the Hawaiian Islands, of which the following is a brief outline:

On first arriving in Honolulu one is struck by the great variety of tropical vegetation in the city. Of these tropical growths the palms are especially noticeable, the finest of all being the royal palm, *Oreodoxa regia.* Of the other showy plants the various leguminous trees with showy flowers were conspicuous, and of these the handsomest was *Poinciana regia.*

An examination of the shore region outside the city shows that practically none of the garden plants are indigenous, and that the vegetation native to the site of the city is very scanty. In the valleys back of the town, however, where the rainfall is very heavy, vegetation is abundant and varied.

The cane and rice plantations in the vicinity of the city, as well as elsewhere in the islands, are conspicuous features, and, with taro, constitute the staple crops. Cocoanuts are found everywhere near the sea, and banana and pineapple plantations are common.

Other fruits noted were oranges, mangoes, papayas, guavas and others less frequent.

Trips were made to Hawaii and Kauai, respectively the most southerly and most northerly islands of the group.

Attention was drawn to the great difference in the amount of rainfall upon different parts of the islands, especially upon the two sides of Hawaii. At Hilo the annual rainfall is 180 inches, and the vegetation in consequence extraordinarily luxuriant. Here the ferns reach wonderful development and the tree-ferns reach their full size and beauty. The ferns belong to much more diverse groups than in the United States, and all of the principal groups are represented.

On Hawaii the largest forests trees were met, but the variety is much less than on Kauai, which is much richer, especially in flowering plants.

The different geological age of the islands was referred to, Kauai being the oldest and Hawaii the youngest. Hawaii is, indeed, still in process of formation.

The islands being so isolated, and never having been connected with any other land have developed a most peculiar flora. Of the flowering plants and pteridophytes together almost 75 per cent. are strictly peculiar to the islands, while of dicotyledons the percentage is about 85, the highest known in any area of equal size.

*October 17, 1892.* The Vice-President, Mrs. S. W. Dennis, in the chair.

The following were elected to membership: Prof. W. R. Dudley, Mrs. R. F. Bingham, Mrs. R. M. Austin, J. H. Redfield, E. J. Buell, Prof. M. L. Seymour, Miss Emma Chismore, Mrs. Sophia E. Wilson, L. M. King, Christian Dahl, Dr. F. O. Jacobs, Miss Emma A. Shumway, W. A. Setchell, W. S. Lyon.

CALIFORNIA ZOOLOGICAL CLUB. *August 19, 1892.* The Vice-President, Walter E. Bryant, in the chair.

Mr. Bryant addressed the club on methods of preparing bird skins.

The charter roll was declared closed with this meeting.

*October 1, 1892.* Dr. Harkness in the chair.

Dr. O. P. Jenkins, of the Leland Stanford Jr. University, delivered an address on Recent Explorations in the Yellowstone National Park. The lecturer spoke in substance, as follows:

Despite the perpetual explorations of the Yellowstone Park by tourists, there is still much to be learned there from a zoological standpoint. Fish Commissioner McDonald has been especially interested in the Salmonidæ of the west, the trout, grayling and salmon, and much money has been spent in investigating the subject in this region. In 1889 Messrs. Jordan and Gilbert made a careful survey of the park for the purpose of determining the limits of the troutless area, which is situated in the Shoshone and Lewis Lake region, and includes the streams running from these two bodies of water. The explanation of this troutless area is not far to seek. The district in question is a greatly elevated volcanic region forming a high plateau, and the streams arising upon it invariably plunge down high falls. Accordingly, although trout are plentiful up to the falls they are unable to ascend to the plateau above. This elevated area is a beautifully timbered region, interspersed with grassy meadows affording ample feed for horses, and has now been well stocked with trout by the Fish Commission.

In 1891 I was sent with Prof. Evermann, of the Fish Commission, to this locality to see how the trout which had been left there were doing, and to see what other streams in the region might be stocked to advantage. A fine opportunity was also presented to work out an interesting problem in the geographical distribution of the trout of this district. We started from Two Ocean Hotel, with a pack train of eighteen horses and complete outfit, for Two Ocean Pass, a pretty meadow valley of high elevation, from which flow a number of streams, some ultimately reaching the Atlantic and some the Pacific system of water courses. The trout in the two water-courses had been considered as two species, but Dr. Jordan, after an examination of a large series, pronounced them to be the same. An examination showed that one Atlantic stream had piled up a gravelly bank and the water had been dammed up so that by the removal of a few stones a strong stream ran off towards the Pacific creek. Trout were found on both sides of the divide in this instance. Near at hand another stream was found, which could be made to flow in both directions from the divide by diverting its channel at a slight bend, and allowing the water to flow up one arm and down the other of a sort of Y.

The bull-head, blob, or miller's thumb, as it is variously called, is found in this troutless area above the falls, especially in the Gib-

bons River. Strangely enough no blob are found in Yellowstone Lake or River, which are alive with trout. Why it should go where it apparently could not get, and did not go where it might easily have been, is indeed a mystery. Geysers occur at various points near the shore of the Yellowstone Lake, where there is a sudden contrast from ice cold to boiling water. Trout may be caught and cooked in the same body of water, almost without stirring from one spot. In fact, not unfrequently they swim into a geyser unawares and are speedily killed. All these trout of the Yellowstone Lake and River are infested with a parasite—a cestode worm. It sometimes lodges in the abdominal cavity, sometimes in the pyloric cæca or intestines, but most frequently in the muscles. For some time we were unable to understand how it was that the trout of the Yellowstone Lake were thus infested, while those of Jackson Lake were not, but the explanation was at last found. The California gull and white pelican are hosts of the adult form of this parasite, which lives in their intestines. The eggs of the worm, when voided by the birds are eaten by the trout, and developing there into the larval stage burrow into the muscles of the fish.

In an interesting stream known as Crawfish Creek no fish were present, but an abundance of crawfish (*Cambarus ambellis*). Grayling were restricted to Firehole River and Gibbon River, which flow together. The temperature of the water makes a great difference in the size of trout, an extremely cold temperature retarding growth, and it is on this account that most of the Yellowstone trout are comparatively small in size.

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## NOTES.

The Journal of Botany for July says: "British botanists, especially London ones, will regret to learn that the introduction of plants into localities where they may become established is being carried on with considerable energy by a member of a London Natural History Society. Hampstead Heath and Keston Bog are two of the places where this pernicious and unscientific action has occurred; and *Parnassia* and *Pinguicula vulgaris* were planted in the New Forest bogs by the same individual. In this case it was possible to nullify the attempt; but the precautions then taken may be easily evaded, and it is to be feared that in some cases the imposition may be successful. We trust that the society referred to will take steps to disassociate itself from so disreputable a proceeding."

Unless there is more in this note than meets the eye of a casual reader it is difficult to see why the writer objects with so much vigor. Nature aided by the peregrinations of man diffuses many of the unsightly and objectionable of her plants pretty widely, and if no attempt is made to deceive, why should not the ornamental ones go visiting also? We would hold that man a benefactor who would vary the prevailing yellow of our autumn fields by the beautiful New England Aster, make our swamps acquainted with the Osmunda and the Side-saddle Flower, or hide in our forests the Indian pipe.

Prof. W. R. Dudley of Cornell is expected in California in December to take charge of the department of Phanerogamic Botany at Stanford University.

Miss Faustina Butler, in charge of the World's Fair exhibit of California Wild Flowers, would be grateful for seeds, bulbs, etc., of our showy wild flowers. Address, care of World's Fair Commission, Flood Building, San Francisco.

Miss E. Cannon, 1402 Bush St., San Francisco, wishes to dispose of her herbarium of named Californian plants; some hundreds mounted on large-sized sheets, but the greater part unmounted.

Botaniska Notiser, 1891, Part 4, 174, has the following note upon *Cystopteris Bænitzii* Dörfler: "According to Botan. Centralblatt 1891, nr. 25, pp. 333–4, there is to be found in C. Bænitz's Herbarium Europæum under nr. 6,510 a new Cystopteris species distributed and described under the name of *C. Bænitzii* Dörfler. While the spores of *C. fragilis* Bernh. are closely covered with pointed teeth, the new species possesses spores which are perfectly smooth without signs of teeth, only here and there furnished with isolated irregular, folded ridges or 'combs.' The specimens were found on slate rocks in the vicinity of Kongswold Dovre in Norway. The species is besides only known by its namer from San Bernardino in South California. Among the many specimens in the herbarium of the Lund University no one agrees with the above description except one with the following: '*C. fragilis* lobulato-dentata Wilde. Elstad, in crevices close to a small brook 3/7, 1865, A. Falck.' Elstad is situated in Gudbransdalen. The value of this new species must be decided by future investigations."

If species of ferns are to be founded upon markings of the surface of the spores a fertile field is prepared for the species maker. The numerous specimens of *C. fragilis* in the herbarium of the California Academy of Sciences show every gradation of spore markings, from mere irregular reticulations to the ordinary echinate form. One example from Santa Clara County is covered with irregular warty projections. Specimens from Rhode Island and from Hawaii agree exactly with the description of *C. Bænitzii*, and others from Sierra Mojada, Colorado, are both reticulated and echinate.

The Harvard Herbarium has been reorganized under the name of the "Gray Herbarium of Harvard University," in charge of Dr. B.

L. Robinson, Curator; Henry E. Seaton, Asst. Curator; Merritt L. Fernald and J. A. Allen, Assistants. Much good work may be expected from this group of young and active men, succeeding to the richest herbarium and best botanical library in America, and inheriting from their great predecessors traditions of moderation which may influence the too violent tendencies of nomenclatural reform.

Mr. William T. Davis, writing in Bull. Torrey Club, xix, 301, about a patch of oaks on Staten Island, names one which he considers a hybrid, *Quercus Brittoni.* It will be interesting to observe how persons who act in such wise, propose to distinguish these names from those of valid species. Gardeners, of course, give names to the multitude of hybrids and sports which they produce for trade purposes, but such names are usually of a fanciful form, and botanical science takes little cognizance of them. Our friends, the zoologists, are evidently neglecting their opportunities. How long the army mule, for instance, has led a miserable existence for want of a specific name, yet it is too be feared that if some fervent "disciple" of any eminent zoologist testifies admiration by attaching his name to the long neglected quadruped, the well meant effort will hardly receive the thanks of the complimented.

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ERRATA.—In article on Balanoglossus, Ritter:

Page 190, line 21, for "flow" read "flows."

Page 197, line 34, for "sink" read "sinks."

Page 200, for "Fig. 6" read "Fig. 7;" and for "Fig. 7" read "Fig. 6."

In "List of Abbreviations," for "*v. b.* Ventral blood vessel" read "*w. s.* Water vesicle."

On Plate xxii, Fig. 5, for "*n. s.*" read "*w. s.*"

# Errata Vol. III.

Page 52, for "Ammostrephes" read "Ommastrephes."
" 203. first genus, place second bracket after Richardson.
" 204, No. 11, for "Dona Ana County, New Mexico," substitute "Texas "
" 206, third line, for "James's Bay, Hudson's Bay," read "James Bay, Hudson Bay."
" 206, No. 12, for "macrohabdotes," read "macrorhabdotes."
" 206, No. 15, for "Valley of the Sacramento River," read "Foothills of the Sierra Nevada."
" 208, No. 28, omit "Northwestern New Mexico."
" 213, No. 82, for "nebracensis," read "nebrascensis."
" 220, No. 165, for "Sorrex." read "Sorex."
" 223, eighteenth line, for "Dobson, Mon. Insectivora," etc., read "Dobson, Ann. & Mag. Nat. Hist., 5th ser., xviii, 1886, 124-125."
" 261, seventh line from bottom, for "Am. Rept." read "Ann. Rept."
" 261, second line from bottom, for "Forsteri," read "fosteri."
" 279, fifth line, for "Berkeley," read "Los Angeles."
" 279, twenty-fifth line, for "William M. Price," read "William W. Price."
" 117, in title, for "albicolis," read "albicollis."

# ZOE.

## A BIOLOGICAL JOURNAL.

VOL. III. JANUARY, 1893. No. 4.

## CONTRIBUTIONS TO WESTERN BOTANY. No. 3.

BY MARCUS E. JONES.

CAULANTHUS CRASSICAULIS Watson, is perennial. The four stamens are declined and close pressed to the lower petals, and the two others are as tightly pressed to the upper petals, after the fashion of the Labiate stamens. This grows in loose soil in alkaline valleys as well as in better-drained localities with little alkali. It blooms mostly in the month of May, and is common in Western Utah as well as in Nevada.

STANLEYA VIRIDIFLORA Nutt. The very imperfect description of the type in Coulter's Manual, King's Report, and the better one in the Flora of North America, Torrey and Gray, make it uncertain whether this plant is a new species or not. The salient points of the type are the simple stem, erect and glabrous, leaves cuneate-obovate ("obovate or lanceolate," Watson in King's Rep.), entire or few toothed at base of stem, upper ones rapidly reduced so that the upper stem is nearly naked, entire ("lanceolate, sessile, clasping," Watson l. c.); raceme long and crowded with flowers, which are greenish yellow, with linear sepals and petals, anthers very long and linear, pedicels ½ inch long, stipe an inch ("½ inch," Watson l. c.); long and narrow torulose pod. Said by Nuttall to grow on shelving hills, and apparently by Watson in valleys.

My plants, of which I have a large suite gathered at different places, and which I carefully studied as they grew, are short-lived perennials (3 years old at least), with stems all ridged and more or less winged throughout, the wings sometimes about a line high; leaves lanceolate, barely acute and entire, but with two rounded lobes at the truncate base, root leaves pseudo-petioled and wing margined, as also the lower stem leaves, 6 to 12 inches long and ¾ inch wide, thick, leathery, and light green, smelling like cabbage,

stem leaves rapidly reduced upwards, sessile, apparently (but not) clasping, uppermost ovate to sagittate, or hastate, acuminate, the rounded or almost acute lobes 3 to 4 lines long, petioles of root leaves grooved; spikes sessile and in the fully developed plants many branched; the central branch long, 1 to 2 feet, densely flowered; sepals in the bud greenish yellow, after anthesis purple (usually) and reflexed, linear-oblanceolate, obtuse, concave, almost hooded; blade of petals crumpled crosswise, edges jagged, linear, ½ line wide, yellowish green, inconspicuous, 4 to 6 lines long, and thin, claw thick, fleshy, triangular subulate, 6 lines long and a line wide at the saccate base, glabrous, whole petal just equaling the filiform filament, which is round, glabrous, and scarcely enlarged at base, anther loosely coiled 2½ lines long, obtuse, narrowly linear, fixed by the very base and one-sided; pedicels in flower 2 lines long ascending and in fruit 4 lines long and horizontal; pods drooping, 2 to 3 inches long, stipe 8 to 10 lines long, septum less than ½ line wide. It grows among pinons and cedars on gravelly southern slopes of hills at 6,500 to 7,000 feet altitude in the Schell Creek and Sprucemont Ranges, Nevada, and flowers about July 15 to August 15. The greenish yellow sepals are rather conspicuous. It is not very common. It differs from the type so far as the descriptions go in the winged stems, branching habit, crumpled petals, auricled or hastate upper leaves, and longer pendent pods. But it may be that these characters were overlooked in the type. Should this plant prove to be distinct it may bear the name of *Stanleya collina.*

LEPIDIUM HETEROPHYLLUM. I propose this name for the *L. montanum* var. *alpium*, Watson, King's Rep. and *L. integrifolium* var. *heterophyllum*, Wat. Am. Nat., IX, 268. I fail to see anything warranting the connection of this shrubby based, cliff-growing, decumbent, high altitude plant with *L. montanum* or the alkali-loving *L. integrifolium* of the valleys. It reaches an altitude of nearly 9,000 feet in the Wasatch and shows no gradation into either species either in habitat or character so far as I know.

POLYGALA ACANTHOCLADA Gray. It may be of interest to give the characters of the flowers of this plant as they are in nature and not in dried specimens: Green parts of calyx 3, ovate, barely acute, 1 line long, the two upper (this is as the flower appears on the plant with the keel uppermost) close together, lower one alone, the two

petal-like ones obovate-oblong, widely spreading, cucullate, barely acute, 2 lines long, ascending, white; keel truncate, 1½ lines long, 1 line wide, broadly obovate, greenish; banner oblong-linear, expanded at end and rhomboidal, erose and notched, greenish, tip purple with veins running down ½ line, 2 lines long in all. The keel has an oblong orifice with the lips turned back at more than a right angle; stigma truncate or club shaped and included in the hood; pod oblong ovate, 2½ lines long and 1½ wide, deeply notched. The plant is a shrub 1 to 3 feet high, with gray bark and stems often an inch thick, widely and rather intricately branched and spiny. Gravelly hillsides in dry places. I have collected it at Lee's Ferry on the Colorado River near Southeast Utah, and found it common in Western Utah and Eastern Nevada.

VIOLA BECKWITHII Torr. The description of this plant in King's Rep. is inaccurate, but the figure, etc., in Beckwith's Rep. are better. The following are the characters of our plant as it grows here; it is locally abundant. Stigma cuneate and truncate, glabrous, petals also glabrous, 2 upper ones dark purple, the rest white with a yellow claw and purple veined, lower petals broad, truncate or emarginate, flowers rather large; sepals linear oblong, spur not over a line long; pubescence minute and dense; leaves 3-divided, divisions petiolulate, lateral ones 3 to 6 lines long, terminal ones 6 to 12 lines long, lobed or cleft into many linear or oblong segments.

LUPINUS SULPHUREUS Douglas. This little known plant I discovered growing abundantly in Eastern Nevada, and I think it is quite probable that it will be found to be nearer *L. sericeus* than has been supposed. My notes on the flowers were taken as they grew. When the flowers are just opening they are white with a yellow streak in the middle of the banner, which is also flecked with 4 or 5 small purple spots; the whole flower soon turns yellow, the middle of the banner deeply so. The calyx is long-spurred, spur and all but the tip of the upper part of the calyx white and streaked with blue, the lower part of the calyx and tips green. It grows 1 to 2 feet high, in clumps from a hard woody root, on gravelly slopes, flowering in June. I have a very few specimens with a suspicion of blue on the banner.

PSORALEA CASTOREA Watson. As I suggested in a previous note (No. 2) this includes *P. mephitica* Watson. A careful compari-

son of my many specimens from Southern and also Eastern Utah and Colorado shows that the distinctions relied upon by Watson to separate the two species are valueless, while the "mephitic" odor was doubtless due to the animal rather than the vegetable kingdom.

The following characters will fit my suites of specimens. Leaves 1½ inches long, from rhomboidal obovate to spatulate, acute, apiculate or retuse; stipules persistent or caducous, the larger ones 1 inch long, ovate, obtuse, and persistent, the smaller ones ⅓ inch long, ovate-lanceolate, abruptly contracted into a long acumination and caducous; stems none to 4 inches long; petioles 2 to 6 inches long; peduncles shorter than the leaves; bracts ovate, scarious, obtuse to abruptly contracted and with a long acumination, equaling the scarious, inflated calyx and blue and white petals; calyx lobes linear to lanceolate, acute or long acuminate; spikes 1 to 3 inches long; peduncles 1 to 4 inches long and stout; pods lanceolate, glabrous below the middle and long villous above it; roots very deep and apparently tuberous, but really woody and all connected underground; whole plant densely pubescent, with short or long hairs, upper side of leaves less so or glabrous. Grows in patches either in sandy places or on rocky slopes in dry places; flowers in May.

ASTRAGALUS. Doubtless many have had much difficulty in determining species in this genus from the flowers alone; at least I have found it exasperatingly so, and, as the pods are often not to be had when the flowers are seen, and as the flowers have been almost ignored, I began some years ago to study the flowers with a view to determine if they had any specific value, and with good results; how good cannot yet be determined fully.

I find that the arching of the banner and its shape are valuable, the shape of the sulcus in the banner, the shape of the white spot on the banner in a general way, and the backward folding of the sides of the banner are valuable; the shape and length, as well as the position of the wings, are valuable. Often the wings are concave to the keel or flat, horizontal, or arched upwards, connivent over the keel or with the blade edgewise to it, and so like the outspread wings of insects. The shape of the keel, its arching and tip, are also of value in separating species. I find little or no difficulty in separating species by these characters in conjunction with the leaves. Whether they are of value in making sections I doubt,

but they are good in making smaller divisions, where now we have considerable difficulty. I hope Californian and Northern botanists will report on these things with their species. It is necessary to take the notes on flowers when they are growing, and as soon as they are fully opened, before they have assumed a false position of banner or wings. The following are my notes on living flowers, with descriptions of some new species, following the order of Watson in King's Rep. in a general way:—

ASTRAGALUS DIPHYSUS Gray. Banner broadest at base, sides slightly reflexed at the top, not at all at base; white spot broadly cuneate and very slightly notched at top. It comes within a line of the tip of the banner. The banner is ascending less than 30°, sulcus V shaped. The calyx is cleft on the upper side, acute at base, and the lobes are unequal, the lower the longer.

ASTRAGALUS DIPHYSUS Gray var. LATUS. Like the type but the leaflets 3 to 5 lines long, 6 to 8 pairs, ovate or obovate to oval, obtuse to emarginate; calyx teeth shorter and broader, 1 line long, the tube 3 lines long; pod oval, straight, abruptly acute, completely 2 celled, rather deeply sulcate both dorsally and ventrally. Whole plant glabrous even to the pods, subdecumbent; lower stems enduring from year to year, many stemmed from a deep, thick, woody root, stems spreading more or less underground. The flowers are purple from a light-colored base, 6 lines long, and the cross section of the pod is nearly two circles, joined at the side. Schell Creek Range, Nevada, May, on the hillsides.

ASTRAGALUS BECKWITHII Torrey. Flowers cream white, never purple; banner almost erect, deeply notched, sides not at all reflexed, except at a point opposite the tip of the keel, where it is turned back for a space of 2 lines long, and at a point near the tip, and so is fiddle shaped, water lined. The sulcus in the upper part is broadly V shaped, but in the lower part of the banner it is almost circular, making the base of the erect part of the banner very convex on the outside, and narrowed at its insertion into the enlarged club-shaped lower part, and this narrows as it enters the calyx; banner 4 lines wide and 6 lines long above the calyx; wings obliquely oblanceolate, narrowed at the tip and nearly acute, 2 lines wide, nearly straight, 3 lines longer than the keel; keel long and narrow, slightly incurved, faintly purple veined at tip; leaflets generally emarginate;

pods without mucilaginous matter. This is quite common from the Wasatch Mountains to the western side of the Fish Spring Mountains, in Western Utah. West of there it is replaced by the next. It grows on gravelly hillsides. Pods purple spotted, thin and acute at each end.

ASTRAGALUS BECKWITHII Torrey var. PURPUREUS. This plant, though it has all the marks of a good species, I do not feel like describing as such till one or two things can be settled about it. Banner purple, fiddle shaped, notched at top and broad at base, arched to nearly 90° and abruptly, white spot fan shaped and streaked deeply (to the base on the sides) with purple; sulcus ¼ circle except at the base, where it is semicircular, fusiform longitudinally; the purple streaks on the white spot are united at the base of the sulcus into a purple ring; the banner is bent at a point 2 lines beyond the calyx teeth; wings obliquely ovate, rounded and obtuse at the apex, white from the tip to the keel and purplish beyond, upwardly curved, 2 lines wide, 2 lines longer than keel; keel purple and very dark at tip, incurved 100° to base, blunt. Whole flower curved upwards, purple and never yellowish except when old. The other characters are leaflets 6 to 12 pairs, inclined to be diamond shaped, 6 lines or less long and over ½ as wide, rounded, truncate or retuse; stems ascending, angled as well as petioles and peduncles; flowers 6 to 10, at first in a head but lengthening to 1 to 2 inches; penduncles shorter than the leaves; calyx as in the type, yellowish but with nigrescent hairs, tube 2 lines by 1½; teeth 1 line more, subulate from a broad base, almost black; calyx spreading in flower and reflexed in fruit, but the stipe (equaling the teeth) bent upwards so that the pod is nearly vertical; pod acuminate at each end, inwardly curved ventrally, so as to make ⅓ to ½ the arc of a circle, 1½ to 1 inch long, dorsal sulcus intruded ½ line, sulcate dorsally always at base, but not in the upper half when pod is much curved; when nearly straight and only acute at base and apex (which occasionally occurs) the pod is deeply sulcate, finely corrugated, cartilaginous, fi led with a mucilaginous pulp when immature; seeds flattish, nearly round, with a prominent hilum, 1 line wide. Fully mature pods are usually obcompressed so as to be flat, while at the ventral suture they are compressed, making the cross section T shaped, usually purple spotted. This differs from

the type in the purple flowers, keel ½ broader, longer pod, which is cartilaginous and so thicker, pulpy pod, while the type has a thin and almost transparent pod, without pulp when young. If this latter point holds good in all cases, it is a good species. It is at once distinguishable from the type everywhere, and never has been found east of the Deep Creek Mountains in the western edge of Utah.

ASTRAGALUS CANADENSIS L. and A. MORTONI Nutt. have the following characters in common: Flowers in dense spikes, horizontal; calyx white, flattened, somewhat gibbous, hairy, tips broadly triangular and tufted with hairs, short; banner arched in a wide arc, sides reflexed, at tip the most, very little elsewhere; sulcus triangular and acute at tip of banner, rounded at base of banner; banner equaling the keel, ochroleucous; wings ascending and narrow, exposing both the tip and base of keel, obtuse, a line longer than keel.

ASTRAGALUS CANADENSIS has calyx decidedly notched on the upper side; bracts subulate, short; wings linear but slightly wider at blunt tip; keel little incurved; leaves in about 13 pairs and inclined to be lanceolate; spikes not denser fruited than in the other species. The keels of both species are veined.

ASTRAGALUS MORTONI Nutt. Calyx teeth not unequal; wings oblong-lanceolate, 1½ lines wide at base; keel purple tipped, arched to ⅓ of a circle; bracts ovate to lanceolate, 1 to 2 lines long; leaves inclined to be oblong and much smaller than in *Canadensis;* flowers in a closer and shorter head. Pods pubescent and densely aggregated, ascending as in the other species.

*A. Canadensis* was just coming into bloom at Grinnell, Iowa, on August 16, 1892, at 1,000 feet altitude, while *A. Mortoni* was well in bloom at Muncy, Eastern Nevada, on July 6, 1891, at 6,000 feet altitude.

ASTRAGALUS DODGIANUS, n. sp. Many stemmed from a woody root; stems very slender, flexuous, branching from the base, 6 to 24 inches long; stipules sheathing at the base, membranous and barely pointed, upper ones connate at base and very broadly triangular; whole plant except the glabrous pods minutely and sparsely pubescent; leaves 1 to 2 inches, with proper petiole ½ an inch; rachis leaf-like; leaflets 4 to 5 pairs, narrowly elliptical to linear, 2

to 4 lines long; peduncles 3 to 8 inches long, with racemose, scattered flowers on the upper half; flowers very small, erect to horizontal; calyx nigrescent, less than a line long; campanulate, triangular teeth a line long; calyx acute at base, on a pedicel ½ a line long, subtended by a triangular bract 1 line long; corolla arched; the very blunt, much incurved, and rounded, purple-tipped keel surpassing the calyx tips less than a line; wings oblong, entire, about a line longer than keel, ascending, flat to keel; banner abruptly bent at calyx tips to a right angle, 2 lines longer than keel, broad, deeply notched, white or light pink; pods ascending to pendulous, linear-oblong, dorsal suture straight, ventral slightly curved, minutely stipitate, flat and vetch-like, abruptly acute or apiculate, membranous, reticulated, with no trace of a dorsal intruding septum; seeds (6 to 10) broadly ovate to almost reniform. Were it not for the characters of the pod this might be referred to *A. Robbinsii*, var. *occidentalis*, Watson. May 7, 1891, at Thompson's Springs, Eastern Utah, on rocky slopes, rare. Named for Col. D. C. Dodge.

ASTRAGALUS IBAPENSIS, n. sp. Allied to *A. Robbinsii*, var. *occidentalis* apparently, but leaves seemingly quite different, and pod also. (?) The description of Watson's variety is very meager and gives almost no leaf or floral characters. This plant is very slender; stems ascending from a deep, erect and slender perennial root; leaflets 1 to 7, elliptical to linear, lower obtuse, the upper acute, all but the terminal ones 2 to 6 lines long, the terminal one twice as long as the others; upper leaves with one long, linear leaflet, acute at each end, 1 to 1½ inches long, 1 line wide, gradually tapering into the rachis or petiole, which is 6 lines long and not jointed to it, occasionally with a single falcate, very acute, linear leaflet at base; stipules ovate to broadly triangular and mostly connate, usually acute; very slender stems grooved; whole plant minutely strigose pubescent, even to the pods, which are more densely so and not black hairy; penduncles slender, racemosely arranged on stems, 1 to 2 inches long; flowers white, 1 to 3, at the top of peduncle; spreading pedicels a line long and with an ovate bract at base, apparent reflexed in fruit; calyx shortly campanulate, a line long and as broad; teeth triangular, ½ line long; corolla 3 lines longer than calyx and teeth; banner very broad, abruptly arched at tip of teeth

to a right angle, erect part 1½ lines long; keel surpassing calyx teeth 1½ lines, incurved with the end straight, blunt, purple tipped; wings barely equaling the keel; pod oblong-linear, very shortly stipitate, 6 lines long, 1½ lines wide, abruptly acute, both sutures prominent, flattened, apparently 1 celled, ventral suture arched, dorsal straight.

June 23, 1891, Deep Creek Mountains, Western Utah, at 5,500 feet altitude, among brush. The arching of the ventral suture of the above two species would suggest *A. Robbinsii*, as that feature is very rare in Western plants, but the racemosely arranged short peduncles and upper simple leaves are quite peculiar.

ASTRAGALUS BIGELOVII Gray. This in its flower is allied to the *A. eriocarpus* group along with *A. amphioxys*, and apparently should include the *A. Mathewsii* Watson if there are no other good characters than those given by Watson. Banner arched 80° in a gentle curve, sides reflexed from calyx to tip 100°, the folded part being 1½ lines wide at base and gradually reduced upwards so that the outline of the banner as one looks at it is oblong with straight sides and an enlargement at the base; sulcus a line deep and ¾ wide, broadly V shaped and continuous to the apex of banner, white spot occupying the whole of the sulcus and to within a line of the top of banner, narrowly oblong, emarginate, purple tinged below; base of banner, sides and tip rose purple, darker at the base; wings linear, ¾ line wide, with a little lobelet on upper side near the base, obtuse, ½ line longer than keel, ascending 30°, dark rose purple at base and the upper two lines white, nearly flat with the tips slightly incurved and so not quite vertical; keel dark purple-tipped, blunt and moderately incurved; banner rising 4 lines beyond the tip of keel, in all 5 lines longer than tip of calyx lobes; calyx pink, a little inflated, narrower with age and white, somewhat flattened, gibbous, ascending 45°; bracts 3 lines long and green.

Taken from specimens gathered at Rincon, New Mexico, April 15, 1892. It is also abundant in Eastern Utah.

ASTRAGALUS GLAREOSUS Douglas. The plants which I have hitherto distributed as *A. glareosus* are *A. Chamæleuce* Gray, while this plant occurs sparingly throughout the Great Basin region of Utah, and is credited to Southern Idaho, and by Coulter to Wyoming also. I have hitherto considered it as *A. Chamæleuce* but it

is clearly not that plant, and differs from *glareosus* in having a 2-celled pod that is 1 celled at apex only, the flowers also are cream white, and not "blue," indistinctly purple veined. Pods long, 1 to 2 inches, acuminate, lanceolate, fleshy when green, much compressed, 2 celled by the intrusion of the dorsal sulcus, long-appressed hairy, often sulcate both dorsally and ventrally, dorsal sulcus very deep; banner extending 4 lines beyond the calyx teeth, slightly and gently arched, notched, sides reflexed at base only, 2 lines longer than the blunt, incurved and purple-tipped keel; sulcus deep, semi cylindric, wings linear, a little longer than the keel, horizontal at tip; calyx cylindrical, 5 lines long; teeth subulate, a line long or more, nigrescent peduncles 2 inches long, shorter than the leaves and prostrate in fruit except in the shade, leaflets narrowly lanceolate to narrowly oval, 3 to 5 lines long and 1 to 2 wide; whole plant coarsely silky pubescent with appressed hairs; stemless, not at all woolly. It grows under sagebrush in the valleys or lower hillsides and is quite distinct from any other species that I know. It flowers early in May.

ASTRAGALUS UTAHENSIS, T. & G. Though it is difficult to always separate this from *A. eriocarpus*, and less so from *A. Purshii* in the herbarium, yet it is not at all so in the field, since *A. eriocarpus* flowers at least a month earlier than *A. Utahensis* and is out of bloom before the other blooms. *A. Purshii* blooms as early or earlier than *A. eriocarpus* and is a high altitude plant, *i. e.*, does not grow in the valleys, the home of the other two species, though the latter sometimes go up to 7,000 feet altitude. In *A. Purshii* the pubescence of the leaves is quite different, while the matted habit and narrow leaves and short woolly pods distinguish it at all times. It would certainly be considered a hybrid from the other two if they grew together with it but they never do.

In *A. Utahensis* the banner is oval as one looks at it in the flower, rather deeply notched, white spot broadly cuneate, tridentate or with a single acuminate tooth from the center of the rounded or truncate apex, sides of white spot beautifully veined with narrow nearly parallel purple lines running down to the base; banner brilliant pink purple; wings linear, 2½ lines longer than keel, slightly enlarged at tip, rounded or almost truncate, straight, purple throughout; tip of keel dark purple. This is one of the handsomest flowers in the West, but though very common in Central Utah seems to become less so westward.

Astragalus eriocarpus Watson. Flowers brilliant pink purple, and closely resembling those of the above, but sides of banner not at all reflexed, either notched ½ a line deep or not at all, ascending 45° or less; white spot almost obliterated by rather broad, palmate, purple veins, which are united into a solid purple spot at base; sulcus in banner semi-cylindric; wings a line longer than keel. Deep purple tipped, obtuse, scarcely broadened at base, a little narrowed at apex; keel dark purple, scarcely incurved, very blunt; flowers nearly as large as in *Utahensis*, but fewer. It is abundant in the valleys, but not in alkaline soil.

Astragalus amphioxys Gray. This plant has no characters that I do not find in *A. Shortianus*, except the pubescence of the calyx, which in the former is appressed and silky or strigose, and in the latter is spreading and loose. The shape of the pods, that both Gray and Watson had to abandon in regard to *A. cyaneus*, is equally valueless in the new species created. There may be a character in the flowers to keep up the species, as well as the pubescence. I have not studied *A. Shortianus* in flower as I have the present species. I have never seen any true *A. Shortianus* in Utah or Western Colorado, all the plants belonging to *A amphioxys*, which is very common. The usual form has the banner of the flower ascending remotely from the calyx, which gives the flower a slender, long look, but there are forms with a short corolla. There are also three forms of pod. One is the typical pod, as described by Gray, not fleshy to any extent. Another has a shorter pod, which is less acute at apex, often small, and rather blunt at base. The other has a very fleshy pod, which, on drying, becomes wrinkled with prominent sutures and intermediate in form. While all these forms run together, and have no floral character that is constant, so far as I have seen, they all, without exception, have the appressed pubescence of calyx. The floral peculiarities are brilliant pink purple flowers; banner with sides reflexed 10° to 60°, or even more. When little reflexed the outline is oval, when much it is oblong or tapering upward, ascending; sulcus 3 lines broad and very shallow, only concave, 4 lines long, white spot truncate and often deeply notched, oblong or broadly cuneate, ragged on the upper end, with little purple veinlets, stippled with fine purple spots; banner darkest near the white spot, lighter on the edge; wings linear to oblong lanceo-

late, rounded, obtuse, oblique, ascending, concave to keel, nearly horizontal and connivent over the keel, forming an arch over it, 2 lines wide and ½ a line longer than keel, purple; keel all purple. One form has banner 5 lines long, short; calyx 3 lines long, and teeth 1½ lines long; pods hoary, and whole plant densely silky. Another form has fleshy pods, less hairy; calyx 4 lines and teeth 1 line long; keel rounded, ½ narrower than the above; flowers 8 lines long. This plant is instantly recognized by the arched and connivent wings and stippled white spot.

ASTRAGALUS CHAMÆLEUCE Gray. (Distributed by me as *A. glareosus*, but not in my sets.) Flowers 1 inch long, pink purple, few; banner in flower oblong-oval, sides reflexed 45°, plain, dark pink-purple with darker veins, tip with a central notch ¾ line deep, and with two shallow ones adjoining, seldom absent; white spot comes within a line of the edge all around and as low as the keel, narrower below, obovate-cordate, edge ragged, with red-purple veins; below and a line apart are two patches of anastomosing red-purple veins; wings narrowly oblong, dark purple at tip, oblique, rounded, tip twisted just below tip of keel, and horizontal; keel narrow 2 lines below tip, blunt and rounded, dark purple at tip; pod very fleshy, cartilaginous, and sparsely short hairy. It always grows in firm, damp meadows, in mountain parks, or high valleys. It blooms in June and July. It is a matted, woody-rooted, prostrate, densely branched, silvery plant, with short peduncles among the leaves.

ASTRAGALUS IODANTHUS Watson. This is the most variable plant of the genus in Utah, and may include several species recently erected. The sides of the banner are reflexed, so that the outline is oblong, notched; white spot, deep purple veined; banner deep purple below, and shading to white at tip, or purple throughout, slightly sulcate, ascending 30°, sides most reflexed at base; wings long, dark purple at base, and white from tip of keel to apex, 3 lines longer than keel, rounded, obscurely erose or notched, ascending near the tip. The pod is fleshy, black hairy or nearly glabrous, plain or spotted, straight or arched into a semicircle, round or obcompressed, sulcate or not. It grows everywhere except on alkaline flats in the valleys, but does not go beyond the higher foothills of the mountains.

ASTRAGALUS PEABODIANUS n. sp. Inflati. Perennial, matted cæspitose from a branching root; stems 3 to 6 inches long, densely branched and prostrate, very leafy, root not woody; leaves 1 to 2 inches long, including the ½-inch petiole; leaflets 4 to 8 pairs, 3 to 4 lines long, 1 to 1½ wide, oblanceolate to narrowly oval, rounded at apex and acute at base, edges contiguous, softly pilose with spreading hairs, as well as all the rest of the plant, even to calyx and legume, but the latter rather densely long pilose; peduncles an inch long, 3 to 6 flowered, and loosely so; flowers ascending, in fruit horizontal, pedicel very short; calyx campanulate, a line long, teeth the same and setaceous; banner abruptly reflexed at tip of calyx teeth, broad, notched, white or purple, 3 lines long, erect part 2 lines long; purple tipped keel surpassing calyx teeth by 1½ lines, arched, the acute tip incurved to nearly a semicircle; wings barely surpassing keel, lanceolate, entire, obtuse; pods 6 lines long, membranous, ovate or lanceolate, acute, sessile, when ripe incurved to nearly a semicircle, cross section triangular and acute at ventral suture, with rounded lobes at base, dorsal septum not intruded, but dorsal sulcus always so at base of pod and to the middle; 1 celled, no intrusion of ventral suture, but the suture is rather thick, while the dorsal is inconspicuous.

Resembles *A. Parryi* in habit, and is allied to *A. triflorus* and *A. triquetrus*, but quite different; clay soil, at 5,000 feet altitude, Thompson's Springs, Eastern Utah, May 7, 1891. Dedicated to George Foster Peabody.

ASTRAGALUS GEYERI Gray. Banner oval to ovate, but sides generally turned back at some angle less than 90°, then the outline is oblong, slightly notched, white or very light purple, faintly purple veined; white spot scarcely visible, coming within ½ a line of the sides and end; banner ascending to 75°; sulcus shallow, scarcely contracted at base; banner 1½ lines longer than wings, and wings 1 to 1½ lines longer than keel; blade of wings obliquely ovate, obtuse, ascending 30°, 1 line wide; keel a line longer than calyx teeth, incurved 100°. I have doubts that it is annual, for the slender roots seem to have tubers on them. Very common in gravelly or light soil in the valleys and lower slopes. It blooms May to June.

ASTRAGALUS PLATYTROPIS Gray. This interesting subalpine plant is found only on the high mountains, occurring as far east as the

Schell Creek Mountains only. It may, however, exist on the Deep Creek Mountains. It is one of the earliest bloomers, close to snow. It is inclined to spread from the roots, but never forms mats. It is rare. Banner white or dirty, tinged with yellow, varying to light lead colored, bent abruptly to 45°, from mouth of calyx, concave, and so the sulcus is very widely V shaped, hooded at apex by the narrowing of the sulcus, 3 lines long, notched, and often with accessory notches, about as broad as long but a little wider at base than apex, sides not reflexed or but little, slightly purple veined opposite mouth of calyx; wings arcuate upwards and exposing the whole keel, obliquely lanceolate oblong, or nearly so, obtuse tip bent outward forming with the keel the letter T, just equaling the keel; keel abruptly bent 90°, purple, dark at tip, point rounded, equaling the banner; pod dark and dark purple mottled, ovate, ¾ by ½ inch, abruptly pointed, straight, papery, and much inflated, oblong oval, cross section oval contrary to the partition and emarginate on each side, prostrate when ripe. Scapes erect to decumbent. July.

ASTRAGALUS TOANUS n. sp. Allied to *A. nudus*. Lower leaflets 3 to 6 pairs, upper ones reduced to the long and cylindrical rachis; pods 2 to 4 on the ends of rather long peduncles; erect, ¾ to an inch long, 3 lines wide, compressed, erect, straight or curved, acute, thick and corrugated, both sutures prominent; sessile, lanceolate oblong, with very acute edges, cross section elliptical, seeds 1½ by 1 lines, calyx teeth minute, triangular; calyx 3 lines long. This grows in clumps like the others of the section. It is nearly glabrous throughout, erect, 2 feet high. It was out of flower July 21, 1891.

Found on the slopes of the Toano Range, Eastern Nevada, in open ground. It can neither be referred to *A. nudus*, *A. pectinatus*, or *A. Grayi*, but is intermediate between *A. nudus* and *A. pectinatus*. It may be that all four are forms of one polymorphous species, but I do not know of connecting forms.

ASTRAGALUS ARTIPES Gray. This plant is so like *A. Beckwithii* (except possibly the fiddle-shaped corolla) that it will be passed over generally when not in fruit; however, the calyx teeth about equal the tube, and are thread-like at tip; pod 1½ by ¾ inches, spotted, straight, tip slightly curved and almost blunt, base truncate; stipe equaling the calyx teeth; no apparent dorsal suture, ventral not prominent nor inflexed; pod probably round in cross section but

somewhat flattened or sulcate ventrally, 1 celled; seeds not round; calyx erect in fruit; pods erect or spreading. It is 1 to 2 feet high, slender. It was collected in gravelly soil at about 5,000 feet altitude in Utah Valley, May 16, 1891. The leaflets are broadly lanceolate to oval, obtuse to emarginate, 3 to 6 lines long, 10 to 14 pairs. Hitherto this has been supposed to be a southern species, but it has doubtless been overlooked.

ASTRAGALUS CALYCOSUS Torrey. This most interesting and badly named little species proves to be very common in all the ranges and hills west of the Wasatch Mountains, Utah. I have gathered it as far west as Humboldt, Nevada. Watson's description in King's Rep. is faulty also. Outline of banner oval, cleft a line deep, sides reflexed 100°, generally cream white but often purple; white spot broad, with cuneate sides to the middle where it widens again, broadly emarginate at apex; sulcus rectangular and broader than deep; wings very closely appressed to keel its full length, red purple to tip of keel, white beyond, deeply cleft, lower lobe 1 to 2 lines long and like a normal wing, the upper lobe is ⅓ wider, bent upward and inward till it touches the banner, both lobes narrowed and rounded at tip, usually from the cleft in the wings a long thread like lobe arises and is nearly as long as the lobes; keel enlarged just above the calyx so as to make a hollow in the banner, with a decided hump near the base of keel; calyx notched deeper on the upper side; pod always arched when well developed, acute, 4 to 12 lines long, 2 celled, cross section ovate with a cordate base. Flowers erect or prostrate, pods narrowly oblong to linear, usually prostrate. It is not subalpine, as given by Watson; it is rare above 7,000 feet altitude and abounds in the valleys in gravelly soil, 5,000 to 7,000 feet altitude. Torrey's and Watson's specimens seem to have been starved and with a poorly developed pod.

ASTRAGALUS ATRATUS Watson var. STENOPHYLLUS n. var. Flowers smaller, leaves narrowly linear, short, minute, or wanting, and only the rachis present, always so in the upper leaves.

This is No. 3840 of my sets of 1882. Collected June 14, 1882, at Palisade, Nevada, distributed as "Astragalus n. sp."

ASTRAGALUS FILIPES Torrey. I believe there is an earlier name for this, but the old name will be the more familiar, and equally as good for my purpose. Banner light cream colored, arched at right angle,

oblong, 4 lines longer than keel, expanded at base like *A. Beckwithii*, sides reflexed 20° or less, groove very shallow and acute, scarcely narrower at base, not enlarged or narrowed on the outside toward the base; banner acutely notched at apex, ¾ line deep; wings obliquely obovate or lanceolate, ascending 45° so as to expose the bottom of keel, concave to keel, entire or obscurely toothed at rounded apex; keel incurved 100° or more, blunt, tipped with yellow. Schell Creek Mountains, Nevada, July, 1891.

ASTRAGALUS KENTROPHYTA Gray. It is hard to believe that a subalpine plant in the Wasatch can be the same as one growing on the driest slopes of valleys in the arid regions, but so far I can see no distinguishing characters. The floral characters of the arid plant are these: calyx bent like Hedeoma; banner arched less than 90° abruptly and with a hump below the bend also, cucullate, sides very concave and little reflexed; sulcus very shallow; banner contracted about a line below the tip, so that the general outline is oblong, tip abruptly reflexed or not at all, deeply notched, a little broader at tip than below, finely striate veined with purple; wings connivent, oblong-ovate, obtuse or barely acute, 1½ lines longer than keel, ascending; keel purple tipped, sharp, and much incurved. Very dry knolls in valleys of Eastern Nevada, fruit in July.

In my last "Notes" in ZOE I inadvertently transposed the terms dorsal and ventral in describing my species of *Astragalus*.

CERCOCARPUS LEDIFOLIUS Nutt. In a former communication in ZOE I gave some general details of the relation of the type to the variety *intricatus* Jones. Having now examined minutely all my material from all sources and also that in the Shaw Botanic Gardens (the Engelmann collection), my conclusions are that there is but one good variety of *C. ledifolius* and that one is the var. *intricatus*, which does not deserve higher rank. *C. parvifolius* Nutt. var. *breviflorus* Jones. I reduce from the *C. breviflorus* Gray, Pl. Wright 2 p. 54. It is clearly a form of the more robust species. *C. fothergilloides* HBK. is quite variable, and some forms are hard to separate from *C. parvifolius*. I studied this latter carefully in the Sierra Mojada in May, 1892 (Mexico).

The following are some notes on *C. ledifolius* and its variety. The species sheds its leaves late in the second season.

July 2, Muncy, Nev. Leaves lanceolate to linear, margins revolute, nearly glabrous, bark dark gray.

November 19, Tintic, Utah. 7,000 feet altitude, leaves old, lanceolate, short woolly on both sides, typical form.

June 12, 1891, Dutch Mountain, Utah. Typical form; leaves broadly lanceolate, not revolute, large, glabrous on both sides, or nearly so below, petiole 2 to 3 lines long, calyx white woolly and tips with a tuft of wool.

July 8, 1891, Ruby Hill, Eastern Nevada, 8,500 feet altitude. Leaves lanceolate, glabrous on both sides, slightly revolute, calyx and tips pubescent only with very short wool.

June 20, 1892, Mt. Ibapah. Leaves broadly lanceolate, slightly pubescent, not white beneath, varnished, slightly revolute.

June 23, 1892, Mt. Ibapah, Western Utah. Leaves oblanceolate to lance-oblong, glabrous on both sides, calyx pubescent.

June 23, 1892, Spring Creek, Eastern Nevada, altitude about 7,000 feet. Leaves, older ones, linear lanceolate, 3 lines wide, scarcely revolute, upper surface nearly glabrous, lower white with very short and dense wool; other leaves on the same plant linear and revolute; anthers nearly orbicular and emarginate above and below.

Specimens No. 2, same locality. Leaves not revolute, lanceolate, an inch long, very woolly on both sides.

August 30, 1891, Moab, Southeastern Utah. Leaves glabrous and varnished, linear and cylindric, 3 to 8 lines long, ½ to 1 line wide; young branches short woolly. This is like Watson's type of *intricatus*, but with smaller leaves approaching the extreme form, with varnished minute leaves, collected by Coville in Southwestern Nevada.

June 9, 1891, Furber, Eastern Nevada. Tails of fruit 3 inches long, short plumose to within ½ inch of the tip, where they are bare; leaves linear-oblong, revolute or not revolute, very woolly or hairy on both sides. The length of the tails is determined by the weather. If it is dry they are very short and abortive; if wet, they are long.

May 20, 1891, Desert Mountains, Utah. Leaves 3 to 6 lines long, ½ to 1 line wide, varnished, cylindrical, densely fascicled.

May 16, 1891, Homansville, Utah. Leaves linear to lance-linear, glabrous or short villous, old leaves less revolute; flowers pubescent, plants less densely branched.

July 2, 1891, Muncy, Nevada. Broadest leaves 3 lines wide and 6 to 12 long, glabrous; narrowest, on the same plant, a line wide; bark darker than usual.

June 19, 1891, Clifton, Western Utah. Leaves 6 lines long, 1

line wide, linear, older ones glabrous and varnished, edges revolute nearly to midrib, and so nearly cylindrical, very abruptly acute; petiole ½ line long; leaves fascicled at the ends of branchlets; intricately branched; bark white throughout, or nearly so. Others from the same place have the leaves 4 lines long, narrowly elliptical, nearly glabrous, and the under surface not chalky white, as is usual in the type.

June 9, 1891, Furber, Eastern Nevada. Branchlets more slender; leaves less crowded, 2 to 6 lines long, younger ones white silky villous, and both sides alike, narrowly oblong, blunt, some scarcely revolute; tails an inch long, the upper half bare, plumose part with hairs 2 lines long and densely white, the hairs gradually growing shorter to the beardless tip. This latter is the case in all forms; calyx 3 lines long.

Specimens No. 2. Leaves very short-woolly, chalky white below, some scarcely revolute; calyx 4 lines long; otherwise as the above.

Specimens No. 3. Leaves densely white woolly, oblong linear, 3 to 4 lines long, 1 to 2 wide, broadest not revolute.

There are many other forms, but those given show the general trend. The variety is usually a densely and intricately branched shrub, 3 to 5 feet high, with light gray bark, abounding in rocky ravines and cliffs and rocky hillsides, forming a large part of the brush of the low mountains. It abounds below 7,000 feet altitude, but rarely grows much higher. The type begins at about 7,000 feet altitude, and runs up to subalpine on the higher mountains. On Ruby Hill, at 9,000 feet altitude, I saw the type matted like the firs near timber line on the loftiest mountains. Both the type and the variety are very much affected by the soil and moisture where they grow. The variety seems to be a form of the type that has adapted itself to conditions that the type, from its larger surface of leaves, cannot do. It is strange that Watson never saw this plant in Nevada, where he spent a season, and where it is very common. It was doubtless an oversight, as he also reported that he did not see *Juniperus Californicus* var. *Utahensis* (as it is now called) in Utah, while it is the only tree on Antelope Island, and the island is black with it, and was when he was there camping. It is also found everywhere in Utah.

RIBES CEREUM Dougl. The flowers have a cannon-shaped calyx; petals white, rounded at tip; calyx tips reflexed; fruit yellowish red

and woolly, as well as glutinous. It is occasional in Western Utah and Eastern Nevada.

ŒNOTHERA JOHNSONI Parry Am. Nat. 9, p. 270. This very poorly described plant is said to have elongated stigmas, petals an inch long, calyx tube not shorter than the leaves, capsules 9 to 12 lines long, somewhat 4-angled, strongly nerved, not crested, and to resemble *Œ. primiveris*, and to be very common at St. George, Southern Utah. The species which I have collected abundantly in Western Utah and Eastern Nevada is perennial, cæspitose from a many-branched root, which is covered at the summit with the dead petioles of former leaves, acaulescent or stems an inch or two long; leaves lanceolate, gradually decurrent into the petiole, which is 1 to 3 inches long, and never more than ½ the length of the blade; blade entire or undulate, or irregularly and sparsely dentate with sharp teeth; whole plant hoary with a dense, soft, and very short pubescence; calyx tips free in the bud; calyx splitting on one side and reflexed in flower, lobes 1 to 1½ inches long, tube 3 to 5 inches long and erect, with 8 striæ; petals rhomboidal, entire or slightly lacerate on the edge; 2 to 3 inches wide, and 2 to 2½ long, golden yellow, palmately veined with 3 very prominent and several intermediate veins, each feather veined in addition; the petals, in drying and fading, turn red, and resemble the meshes in the web of a frog's foot; stamens ½ line wide and 6 lines long, versatile, yellow; stigma lobes 4 to 6 lines long, ¼ line wide; capsule ovate, broadly winged, not nerved or veined, less than an inch long, not crested, hoary white; calyx also with scattered, fine, long, white hairs.

This grows on sunny southern slopes in very dry places, blossoms in June, and is by far the handsomest species of the genus. It is vespertine. Rather common in Western Utah and Eastern Nevada at 6,000 feet altitude. Should it prove to be new, I name it *Œnothera Howardi*, after Mr. A. M. Howard, the gentleman in my party who saw it first.

ECHINOCACTUS PAPYRACANTHUS Eng. The flowers are an inch long, opening but little; stigma cleft a line deep into 6 anther-like divisions, papillose on the sides and upper surface; filaments 6 lines long; style almost as long as the petals, ½ a line thick, linear; the flowers open in the morning, and close in the afternoon, but apparently are not affected by cloudy weather. This grows in alkaline soil, and blooms in May. It is scarce everywhere.

ECHINOCACTUS SIMPSONI Eng. Should be called *Mamillaria Simpsoni*, as all its relatives are there, and it differs in but one respect from that genus, *i. e.*, having the flowers just a little above the base of the tubercle. It blooms in daylight, and closes partly at night. Rather common at high altitudes, *i. e.*, above 7,000 feet. La Sal Mountains, Eastern Utah, and through the Territory and into Nevada. June.

ECHINOCACTUS WHIPPLEI Eng. This opens in the forenoon, and closes partly between 5 and 6 P. M. It also opens in the daytime if put in a dark place. It blooms in June, inhabiting the alkaline valleys and gravelly slopes. Occasional in Western Utah and Eastern Nevada.

OPUNTIA RUTILA Nutt. This is not distinct from *O. Missouriensis*. The flowers close partly at night, and in rain probably. Common. It blooms in May and June.

CYMOPTERUS CORRUGATUS Jones. This is not the type, but is the plant referred by Watson to *C. Fendleri*, and by Coulter and Rose to *corrugatus*. I could not get it with mature fruit. Involucre none; involucels broadly oval and scarious, or lanceolate and green, acute; fruit broadly winged; flowers white. Clayey hillsides near the Sevier River, Utah, below Juab. June, 1880. I doubt that it belongs to either species.

CYMOTERUS IBAPENSIS n. sp. Flowers white, in a head an inch wide; root large and long, thick and fleshy, erect, usually branched at summit, leafless but densely covered with what appear to be old leaf petioles; from amid these the scape arises and is 2 inches long in flower, its summit bears a tuft of many leaves; scapes in fruit 6 inches long or less; peduncles in flower shorter than the leaves, lengthening in fruit to 4 inches; leafless, striate, erect in flower and erect or decumbent in fruit; leaves fleshy and on drying finely wrinkled and so appearing to be finely pubescent, but glabrous, 3 inches long, ternate with the divisions pinnate to bipinnate, ultimate segments obtuse, either obovate and less than a line long or linear-spatulate and 2 lines long; base of petioles of the outer leaves much enlarged, nerved and sheathing, the rest less so; petioles not over an inch long, nerved; umbel of 6 to 8 rays, scarcely perceptible in flower, ½ inch long in fruit and stout; involucre none; involucels

of a few linear, acute, fleshy, not scarious scales, 2 to 3 lines long, distinct to the base; pedicels in fruit 2 lines long, filiform; flowers 5 to 8 from each ray; fruit 2 to 2½ lines long, broadly oblong truncate at each end, face concave only, about ⅓ of a circle, less than a line wide; oil tubes 3 between the ribs and 6 on the commissure; lateral wings a line wide, dorsal ⅓ less, all thick and corky for the size of the fruit. It is a close congener of *C. longipes* but differs in the size and division of the leaves, white flowers, small and simply concave fruit, and habitat. It is found only on clayey alkaline soil in the centers of the valleys. The fruit face is that of *C. montanus*. Deep Creek Valley, 5,000 feet altitude, June, 1891. A feature of the flowers that is more or less common to all the genus is in the petals, which are triangular lanceolate from a broad base, thick, deeply sulcate, barely acute, with incurved apex, so that the tip touches the disk between the contiguous edges of the petals; anthers black purple, reniform cordate, lying on the recurved filament next the edges of the petals like seeds in a five-celled pod, just bursting forth; they are very pretty; the filament straightens and thrusts the anther ½ a line beyond the petal; it then bursts; style not exserted at first.

CYMOPTERUS LONGIPES Watson. This plant is acaulescent at first and the yellow flowers are sessile in a rosette of green leaves, then the flower stalk lengthens always, is erect, and, after blooming, droops till the fruit is pendent, then as the fruit ripens the stem (peduncle) usually becomes erect again. The scape usually lengthens also, but not always. Abundant in the Wasatch and less common westward.

OROGENIA LINEARIFOLIA Watson. The Indians are fond of the raw bulbs. The flowers are white and the peduncles decumbent. This is one of the very earliest bloomers, and, though common, is seldom seen, as the plant is hardly visible when in fruit and even that disappears in a few weeks with the leaves.

TOWNSENDIA SCAPIGERA Eaton. The flowers open between 9 and 10 in the morning and close between 5 and 6 in the afternoon. It is frequent.

I think that Gray has confounded two well-marked species of *Bigelovia* in his cosmopolitan *B. graveolens*. One has a thyrsiform inflorescence, cylindric campanulate corolla with reflexed or widely

spreading lobes a line long, and usually glabrous stems and leaves; it grows 1 to 3 feet high. This is the *B. graveolens* Gray, really (Nutt). The other species is what should be called *B. nauseosa* (Pursh) and is the *Linosyris albicaulis* T. & G. This is also *B. graveolens* var. *albicaulis* Gray, and will include as varieties of it var. *latisquama* (Gray) and var. *hololeuca* (Gray). The type has a fusiform corolla, lobes almost never spreading and never reflexed, usually closed, often short; corymbiform inflorescence, usually flat topped with many heads, occasionally corymbs with few heads and somewhat thyrsiform in outline; stems white tomentose. The corolla is generally with closed lobes and then the fusiform character is very evident; it is always a little contracted at throat. The "cobwebby hairs" are found on all forms of the *B. graveolens* of Gray and are of no value.

*Biglovia albida* Jones. This name was not one of my choosing, but was insisted upon by Dr. Gray, who would not believe that I was correct in saying that the flowers were white. I have again had an opportunity to study this plant growing and find that the flowers are pearly white, the dirty white color of the dried specimens is due to the viscid matter of the heads coloring the flowers. The plant is 1½ to 2½ feet high, grows in clumps like the others, but more open; it is densely fastigiately branched at the top. It is found only on alkaline soil in the valleys and grows alongside of *Sarcobatus vermiculatis*. It is locally abundant on the eastern side of the Deep Creek Mountains, also in Spring, Antelope, and Steptoe Valleys, in Western Utah and Eastern Nevada.

*Helianthella argophylla* (Eaton) Gray. This botanical nomad, which has been successively called *Tithonia argophylla*, *Encelia argophylla*, *Encelia nudicaulis*, *Helianthella nudicaulis*, and now rests under the above name as the proper one, is cæspitose from a deep woody root, 1 to 1½ feet high (the peduncles); hoary with a dense, soft, and very short pubescence; old leaves silvery white, from nearly reniform to ovate, always with a cuneate base, and with a very long and margined petiole, 3 nerved, cauline none, or a rudiment, or occasionally there is a normal leaf at the base of the peduncle, blade 2 inches wide (usually), and an inch long, obtuse and entire; leaves very many and crowded at the root; petioles 5 inches or less long; bracts lanceolate acuminate from a broad base, either

like the leaves or softly tomentose in pubescence, in several series, not recurved, widely spreading in fruit because of the expanded head, which is hemispherical in fruit, not surpassing the disk flowers, obtuse; heads an inch broad and ½ an inch high, nodding in fruit usually; flowers nearly golden yellow; rays about 20, 2 inches long, and ½ inch wide or smaller, narrowly elliptical, minutely 5 toothed at the apex, neutral, usually with two loblets, one near the base of the ligule, and the other near the base of the blade; these lobelets are 3 to 8 lines long, and either green or yellowish: disk flowers urceolate-cylindric, 3 lines long, a line wide; proper tube a line long, very narrow, glandular; lobes reflexed, short, and hispid at tip; style tips bluntly triangular; ovaries nearly linear and slightly widened at tip, white silky with chaff-like hairs; margin hyaline and very hairy; apex with two scale-like awns equaling the short tube; ovaries 4 lines long exclusive of the awn, and flat; mature akenes obovate cuneate, and truncate to narrowly cuneate, black, with white callus margin, which is long villous; body of akene parsely hairy; pappus awns present or absent; crown entire or lacerate, ½ a line high or almost wanting. The leaves are thick and the whole plant so nearly simulates *Balsamorhiza sagittata* that I have no doubt it is quite common where that plant has been supposed to be abundant. It is sometimes found growing near it also. It abounds in Western Utah and Eastern Nevada on sunny and dry hillsides, on the southern slopes, in bare places, from 6,000 feet altitude down. It is abundant at Detroit, Dugway, and Gold Hill, Western Utah, and at Furber, Glencoe, etc., in Eastern Nevada, and doubtless abounds throughout Nevada and Southern Utah. My large and varied material and my field studies make it certain that the two species *argophylla* and *nudicaulis* are identical, and the older name must prevail.

BALSAMORHIZA SAGITTATA Hooker. The horses seem to like the leaves, as I noticed my animals eating it with evident relish. It is frequent throughout the Great Basin region.

TETRADYMIA GLABRATA Gray. The spines of all the species arise from the bark. In this, the "spineless" species, they are present and formed like the other spiny species, but they are so weak and narrow the same year they are formed that they are called spine-tipped leaves, and as they fall at the end of the season they are not dignified with the name of spines. In *T. Nuttallii* T. & G. the spines persist till the second year and then fall.

ARTEMESIA TRIDENTATA Pursh. This is considered a sure remedy for pneumonia, being taken internally, and also a poultice made of it and applied to the chest. One of my men was taken violently sick with mountain fever, his temperature going up to 104° and remaining there; when other remedies failed, I gave him a large quantity of the cold infusion of the leaves, which cured him in a few days.

MALACOTHRIX TORREYI Gray. The flowers close at night.

CREPIS OCCIDENTALIS Nutt. The flowers close at night.

LYGODESMIA SPINOSA Gray. This plant it seems to me has been wrongly referred to this genus; it is a better *Stephanomeria;* in habit it closely resembles the perennial species and also *Chætadelphia,* which is hardly distinct. In some specimens recently sent me from Idaho by Mrs. Brodhead I found the upper ⅓ of the pappus was long plumose like *Stephanomeria* in many cases, while the rest of the pappus was strongly barbellate. The pappus is stout at base and differs from *Stephanomeria* in being multisetose only.

PRIMULA BRODHEADÆ n. sp. 2 to 4 inches high; 1 to 4 flowered; scape 2 to 4 inches long; leaves 1 to 4 inches long, narrowly elliptical, rounded at apex, glabrous, rather thick, smooth, entire, narrowed at base to a winged petiole an inch or less long; flowers purple, about 5 lines wide, lobes orbicular or nearly so, notched, with a very short claw 2 lines long, tube exceeding the calyx by 2 lines; funnel form above the calyx; calyx lobes 1½ lines long and subulate lanceolate, barely acute, equaling the tube of the calyx; pod nearly spherical; pedicels of lateral flowers about a line long, the terminal one 2 to 6 lines long; bracts oblong to ovate lanceolate, entire or toothed at apex, 1 to 6 lines long; base of plant covered with the dead sheaths of former leaves; roots like those of *P. Parryi.* Marshy places at Ketchum, Idaho, May to early June, altitude 6,000 feet. The perfume at first is rather strong and sweet. Dedicated to Mrs. Brodhead, the collector.

Var. MINOR n. var. Leaves an inch long or less, elliptical oblanceolate and acute, thin; lobes of the corolla as large as the type, but obovate; lobes of the calyx longer than the tube; flowers 1 to 2 on the scape; bracts long; plant 2 inches high. Bayhorse, Idaho, July 1, at 8,000 feet altitude, in marshy places. This is between *P. Parryi* and *P. nivalis,* Ledeb, but if the characters given in the Synoptical Flora are good this is a new species. I suppose this species is

the same as var. *Wilcoxiana*, Wood of *P. Parryi*, but I do not know that that was ever characterized in print.

GILIA PUNGENS Benth. is vespertine. I watched it on June 19, 1891, and found that the flowers opened after dark and closed at 7:30 o'clock A. M. I noticed the same thing in *G. Watsoni* Gray, and have no doubt that the same is true of *G. Californica* also. The flowers of *G. inconspicua* and *G. leptomeria* I have never seen fully opened except in sunny weather.

TRICARDIA WATSONI Gray I have found again in two places on Dutch Mountain, Western Utah. It is very rare.

ZYGADENUS PANICULATUS Watson is regarded as a good remedy for felon. The root is baked and applied to the sore.

EPHEDRA NEVADENSIS Watson is regarded as a cure for canker in the mouth and for diarrhœa. It will also produce the piles. The virtües seem to lie almost entirely in the pitch, which, when broken up, is a fine yellow powder and very powerful.

JUNIPERUS CALIFORNICUS Carr. var. UTAHENSIS, Eng. I saw this growing on the top of the Champlin Mountains, Utah, at 7,700 feet altitude, and all matted down and flat-topped, like *Abies fallax* and other conifers above timber line on our highest mountains.

PINUS MONOPHYLLA Torrey. This is very interesting in its young state. Until it is about 5 years old it is scarcely distinguishable from *Abies*. The primary leaves are an inch long, flat, and sharp. After that they grow shorter and little buds begin to appear in their axils; as these develop the leaves dry up and fall off, and there is a complete transition from the fully developed primary leaf to the minute bracts that subtend the young secondary leaves. Generally there are one or two cylindrical leaves scattered along the young stems and with their normal sheaths, while all around them are the primary leaves. I find that the leaves of *P. monophylla* are much more robust and vigorous than those of the variety *edulis* Jones, and so it is far more likely that *edulis* was derived from this than that *monophylla* was derived from it, as it can in no sense be considered a "depauperate form of *edulis*;" in addition, the cones are generally more robust and better developed, though there is an endless series of all sizes and shapes dependent upon the weather in August when the cones are growing. I find that the formation of seeds in the Western conifers, of our region at least, is due to the weather in August. If it

is rainy in that month, as is seldom the case, then the trees fruit abundantly, but if it is dry they seed but little or not at all.

### INDICATIVE PLANTS.

Occasionally we are regaled with accounts of these plants, and one poor species after another is put forth as an infallible index of mineral. *Amorpha canescens* has recently been called the "lead plant," and it is stated that it indicates the presence of lead. If that be true, then the whole State of Iowa, especially the prairie portion, is a vast lead field. Unfortunately there is but little lead known in Iowa as a whole. *Eriogonum ovalifolium* is also made to do service for silver and arsenic in Montana. In Utah it is seldom found near silver mines, and when it so happens that they exist as low as the region that the plant frequents, then it is no more abundant there than it is over thousands of square miles that have no mineral. The plant abounds in all our valleys, and the color is either white or pink, and I dare say that arsenic has nothing to do with the coloring; it is far more likely that it is due to iron, which may or may not be near mines.

### UTAH NAMES OF LOCALITIES.

In almost all the monographs and books giving localities of Utah plants the antique spelling of King's Report is adhered to. Isn't it about time that those relics are given a decent burial? They were invented by some enthusiast in Indian dialects who felt it necessary to put an "h" on every broad "a," whether it belonged there or not. Southern Utah is still groaning under the burden of the outlandish names applied to well-known and previously better named valleys, plateaus and mountains. It is no excuse for these that the names were given by the U. S. Geological Survey, for it has no right to change well-known names for those of its own creation. Some new names for well-known ones are as follows; Kaibab Plateau for Buckskin Mountains, Tushar Mountains for Beaver Mountains, House Range for Swazy Mountains, Wheeler's Peak for Jeff. Davis Peak, Toang Mountains for Toano Range, Mt. Emmons for Star Peak; among the outlandish names applied are Kaiparowits Plateau, Paunsagunt Plateau, Markagunt Plateau, etc.

Two of the bad spellings that I see most frequently in our botanical books are "Wahsatch" for Wasatch, the latter the correct one, and "Uintah" Mountains for Uinta Mountains. Coulter's Manual

errs on the former at all times, also all of Gray's and Watson's publications, and the monographers.

[I had supposed that I had made it sufficiently clear that I was the author of the var. *breviflorus* of *Cercocarpus parvifolius* Nutt. in the original paragraph in which it was printed, but it seems that there is at least one person who has not clearly understood it, so I will say again that the var. is to be credited to me alone.]

## NOTES ON THE OCCURRENCE OF THE PUMA (*Felis concolor* L.) IN SOUTHERN NEW MEXICO.

BY C. H. TYLER TOWNSEND.

[Read before the New Mexico Society for the Advancement of Science, Dec. 1, 1892.]

A recent paper by Mr. F. W. True, in the report of the U. S. National Museum for 1888–89 (pp. 591–608, with plate XCIV), on the puma, or American lion, prompts me to record some available notes on the distribution of this animal in Southern New Mexico, since there seem to be no recorded instances of its occurrence in this part of the country.

The only case which I can personally vouch for is the following: While camped at the base of the Organ Mountains, at the northeastern end of the range, in the latter part of November, 1891, I saw a puma one morning about 8 o'clock disappearing over a ridge of rocks. He had emerged from the high and thick growth of *Yucca angustifolia* which covers the San Augustine plains at this point, and had disappeared before I could get a shot at him. One of the members of our party had passed within a few yards of a yucca, behind which he was crouching at the time, but without seeing him. He was apparently about three and one-half feet long, not including tail, and was of a yellowish gray color. Subsequent search among the rocks failed to show any trace of him. The same morning about three miles west of this place some Mexican goat herders reported that three tigers (*tigres*) had crossed the road at about eleven o'clock, going toward the mountains. This locality is about twenty miles east of Las Cruces, in Doña Ana County.

The following case was given me by Mr. W. E. Baker: In April, 1891, while driving toward Fort Stanton, in Lincoln County, on the

upper road, at a point less than three miles from and to the south of the fort, just after sundown, a puma was seen to spring up from the side of the road, a short distance ahead of the team. This point was not far from a draw containing timber. A shot was fired, which probably grazed the animal's back, for with a low yelp he made off down the wooded draw. The animal was estimated to be about three feet long, not including tail, and probably two and one-half feet high, and was doubtless not fully grown. He was of a tawny yellow color. This locality is on the U. S. Military Reservation at Fort Stanton, in Lincoln County. Some persons who came into Fort Stanton a day or two later on the lower road, reported seeing a puma the following night after the above one was seen. The lower road is about a mile west of the upper one at this point, running more or less parallel to it, and the wooded draw above mentioned connects the two roads. This was perhaps the same animal, therefore, that was fired at the night before.

The puma is not rare in Soledad Cañon, in the Organ Mountains, as the following cases will show: Mr. Jeff Isaacs, who has a ranch in the cañon, has killed twelve of these animals within the past four years. They have caused serious depredations among his lambs and colts. He tells me that they have killed five colts for him, and also numbers of calves and sheep. The skin of one which he killed with a pistol, in the fall of 1889, measured nine feet from end of nose to tip of tail. This measurement is vouched for by Mr. W. R. Fall, of this place. The cañon is a little south of east of Las Cruces, Mr. Isaac's place being about twenty miles from here.

Mr. Fall also tells me that Mr. G. R. Beasley, who has a ranch a mile or two beyond (east of) Isaac's ranch in Soledad, killed a puma in June, 1892, and says that there are several of these animals now alive in that vicinity.

In regard to the occurrence of the puma on the Upper and Lower Penasco, in western Lincoln County, Mr. S. E. Kennedy, of this place and formerly of Tularosa, vouches for the following: The skin of a puma killed by a man named Newman, near the head of the Penasco Creek, in the fall of 1891, measured eleven feet and some inches (three inches?) to tip of tail. Mr. Kennedy vouches for this measurement, which he made himself. This skin, therefore, is the longest one on record, the measurement of which is reliably vouched

for. I am unable, however, to give the length of the body and tail separately. The skin was measured in a straight line, and was of course somewhat stretched. The scalp was left on. The fur was of a tawny yellow color. Mr. Kennedy says that the puma is often met with on the Penasco, and states that the above-named Mr. Newman and a Mr. Wm. York have killed a great many in that region, the skins having been shipped by Mr. Kennedy to St. Louis, where they rarely brought more than $1.00 apiece. The average length of the skins, Mr. Kennedy states, is from seven to eight feet to tip of tail; but he asserts that he has received two or three which were over eleven feet long.

The government offers a bounty of $5.00 on the puma in this territory, and therefore the skins brought in usually lack the scalp.

## NOTES ON FERTILIZATION.

BY ALICE J. MERRITT.

TRICHOSTEMA LANCEOLATUM Benth. The tube of the corolla is so bent back upon itself as to pretty effectually exclude small insects that could otherwise enter. Ants small enough to pass through the tube, were it not for the troublesome corner, are often seen upon the plants; but, though many flowers were examined to determine the method of fertilization, only one minute insect was found which had succeeded in reaching the nectar. The dusty color of the foliage renders this plant inconspicuous to a marked degree, but the bees seem to find it readily, aided doubtless by the strong odor, which probably warns grazing animals of its disagreeable taste. The bee whose visits were watched is an Anthophora. As it alights on the lower lip, its weight instantly straightens the tube, and brings the long curved stamens and pistil against its back with sufficient force to discharge much pollen. A bee too small to be struck by the stamens would have too short a tongue to reach the nectar. The anthers shed their pollen before the stigma matures, so that the bee, in passing from the younger flowers near the top of the stem to the more mature flowers at the bottom of the next cluster, is sure to effect cross fertilization. It is uncertain whether the stigmas mature soon enough to be fertilized by their own pollen should cross fertilization fail.

ZAUSCHNERIA CALIFORNICA Presl. The flowers have an oblique position, with stamens and style close against the lower petals and sepals. After the anthers begin to discharge their pollen, the style lengthens until it is from ¼ to ½ inch beyond them before it unfolds its four lobes and exposes the rough, sticky, stigmatic surface. The pollen is collected in little balls of a few grains each, and these balls are held loosely together and to the anthers by cobwebby hairs. The calyx tube is much constricted above the nectar. The humming birds are frequent visitors to these brilliant flowers, and they can hardly fail to carry pollen on their throats or breasts. I have watched Zauschneria when there were throngs of bees frequenting less showy flowers near by and have seen but one bee visit it. Probably the shape of the flower prevents them from getting the nectar. Its little bronze green visitor, however, seems small enough to reach the constriction, and has, perhaps, a tongue sufficiently long to go through to the nectar, after emerging from the tube. This bee invariably paused on the lower margin of the flower, and seemed to be cleaning its antennæ. In this process some pollen usually became attached to its legs and abdomen and might sometimes adhere to the stigma of another flower. This, however, was not observed. Zauschneria seems to have some chance for close fertilization. Of course, if the pollen simply fell, it would strike the under side of the stigma lobes, not the stigmatic surface; but it usually remains attached to the anthers for some time after the stigma is exposed, and the little masses sometimes swing down on their gossamer threads so far that the slightest jar would send them against their own stigma. During a morning's walk three flowers were seen that had been fertilized in rather a novel way. A seed of the plant, with its tuft of hairs, had been blown against a pollen mass with sufficient force to land it all on the stigma.

## BIOLOGICAL NOTES ON PHAINOPEPLA NITENS.

BY F. E. BLAISDELL.

The Phainopepla is a conspicuous summer resident in the western part of San Diego County, where it is admired for its black, glossy plumage, airy and graceful flight. Even within this region of its distribution there are some localities where it is rarely seen, and this is no doubt due to the absence of its food plants and scarcity of trees.

As a general thing it is rarely observed near the coast, except along the San Diego and Sweetwater Rivers, where willows, cottonwood and oak trees are abundant, and the adjacent hills covered with shrub oak, sumachs, buckthorn, and sage. Rarely seen on the mesas about San Diego and other regions where *Adenostoma fasciculatum*, *A. sparsifolium*, *Hosackia glabra*, *Rhus ovata*, *R. integrifolia* constitute the main flora. With the increased planting of orchards in these localities it is becoming more common.

It is occasionally observed at Coronado since the planting of the avenues with *Eucalyptus*, *Cupressus macrocarpa*, *Olea Europæa*, *Abies excelsa*, *Schinus molle*, *Ficus carica*, *Grevillea robusta*, *Citrus* and palms, but I have never observed it nesting there. In favorable localities it is common and breeds.

Among children and those not conversant with ornithology it is known by the following names:—

Black Crested Flycatcher, Black Mocking Bird, Mountain Phœbe, and Red Eyes.

The Phainopepla arrives at Poway about the first of May, the males usually arriving several days before the females. They are rarely seen after the middle of August.

Poway Valley is situated twenty miles northeast of San Diego, fourteen miles from the seacoast, and thirty miles distant from the edge of the coniferous belt, with an elevation of 700 feet.

The principal plants of this region are: *Quercus dumosa*, *Q. agrifolia*, *Platanus racemosus*, *Populus Wislizeni*,* *Alnus oblongifolia*,* species of *Salix*, *Rhus laurina*, *Rhamnus crocea*, *Prunus demissa*,* *Sambucus glauca*, *Ceanothus sorediatus*,* *Adenostoma sparsifolium*, *A. fasciculatum*, *Artemisia Californica*, *Opuntia occidentalis*, *O. prolifera*.

Shortly after arrival the male selects a site for a nest and proceeds to its construction, which may be completed before the female arrives, but if not she assists. Late arrivals commence labor together. The mates make alternate trips to and from the nest in search of building material, one remaining upon the slowly growing nest, arranging the last accession and pressing it into place; as the returning mate approaches, they exchange a purring salutation and exchange places. The nests are placed at varying distances from the

*But sparsely distributed.

ground, from four to even fifty feet. The materials used are prickly or viscid. The fruit and leaves of some of the members of the Borage family have the preference, together with the leaves and down of species of *Gnaphalium*, all being bound together by spiders' web; the interior of the nest is thinly lined with bits of wool, hair, and down. When completed the nest is fragile, and not sufficient to support the rapidly growing young, and if not placed on a good support, is very liable to give way, and endanger its inmates to the perils of a fall.

The eggs are two (frequently), three (usually), or four (rarely), in number. The mates take turns in the act of incubation. The young are abundantly fed on the berries of *Rhamnus crocea*, *Rhus laurina*, and near to and within the coniferous belt upon the fruit of *Rhamnus Californica*. When disturbed the young birds disgorge the ingesta. The food of the adults consists of berries and insects, and they are beneficial rather than injurious about orchards.

## MARIPOSA COUNTY AS A BOTANICAL DISTRICT.

## IV.

BY J. W. CONGDON.

### THE SUBALPINE REGION.

We have now reached that portion of our county which forms in summer by far its most pleasant and beautiful region. It consists of several uneven plateaus lying between the higher ridges of the mountains and also includes the tops of the lower ridges. While the sides of the mountains up to the limit of tree growth and much of the more level ground are covered with heavy timber, there are, along the water courses, many large open natural meadows where the luxuriant grass, mingled with numberless flowers of varied and beautiful hues, form in this State almost our only representatives of the luxuriant meadows of the east.

The altitude of this region varies from 4,000 to 8,500 feet, thus including all the lower and wooded mountains, and it extends up the higher ones to the upper limit of trees, which is usually about 8,000 feet or a little more.

This tract is pierced by two deep valleys,—the Yosemite and Wawona Valleys, occupied respectively by the main Merced River and the South Fork. The vegetation of these valleys, the floor of which lies from 2,000 to 4,000 feet below the subalpine region proper, consequently includes a larger proportion of plants which belong lower down; but these lower levels are too narrow, and the cliffs that border them and furnish the life-giving supplies of water are so lofty and so full of subalpine vegetation themselves, that they furnish the great majority of the species and control the general character of the vegetation. Hence, in these articles, these great valleys will be considered in connection with the great plateaus through which they cut their deep and narrow channels.

The trees of this region include all or nearly all of those belonging to the coniferous belt. Mingled with these are found the splendid red fir of the Sierras (*Abies magnifica* Murr.); the Jeffrey or black pine (*Pinus Jeffreyi* Murr.); and the tamarack pine (*Pinus murrayana*, Murr., *P. contorta* var. Bot. Cal.) In the upper part of this region the mountain white pine (*Pinus monticola* Dougl.) and the mountain spruce (*Tsuga Pattoniana* Engelm.) become common, while in the Big Tree Grove, south of the South Fork, the huge Sequoias (*S. gigantea* Decaisne) occupy a limited space, fortunately preserved from the spoliation of the lumbermen.

The less heavy and continuous forest, the more open country, and the greater variety of soil and exposure, combine to produce a much more abundant and varied vegetation, while the neighborhood of the loftier summits and the abundance of water prevent the excessive heat and horrible dryness which, in the foothills, makes life in the summer a burden and outdoor activity during the greater part of the day terribly exhausting and often positively dangerous.

These circumstances tend to make this whole region the most delightful and healthful summer resort in our State. While the stupendous scenery and the pleasant climate of the Yosemite are a perpetual feast to the lingering as well as the transient visitor, the other portions of this region, though they may not boast such grand scenery, yet have compensating advantages which make them even more attractive to the seekers for health and rest who desire to make a longer and more leisurely stay than the ordinary tourist. For such of these who prefer or are compelled to limit themselves to

established routes and demand the luxurious accommodations of the modern summer resort, Wawona offers a really pleasanter summer home than the valley itself, under present conditions. But for those seeking pleasure or science who find it agreeable for a while at least to escape the burdens as well as the luxuries of our pampered civilization and enjoy a brief season in the solitary woods and mountains, this furnishes the best possible opportunity for the gratification of their desires. The high plateaus adjacent to Mt. Raymond and the Big Trees, the great divide between the south fork and the main Merced River, over which the Glacier Point Turnpike passes, and still more the region north of the Yosemite, including Lake Tenaya and extending out of the county to the Soda Springs of the Tuolumne, offer to camping parties of the right kind the most delightful opportunities for a stay of weeks or even months. In this last locality they are brought within easy access of all the high mountains in that quarter. Cathedral Peak and Mts. Conness, Dana, Lyell, Gibbs and others form the ramparts of a vast amphitheater, and are easily within the reach of those ambitious of high ascents, while all may enjoy the beautiful and exhilarating climate and other manifold attractions which make life here delightful. Nearly the whole of this region is within the limits of the national park, a circumstance which by wholly excluding the vast bands of sheep that formerly devoured almost every green thing and denuded the natural meadows of every vestige of grass, has made it more accessible to visitors, since there is abundance of forage for the requisite animals and the surface of the country itself is far more luxuriant and beautiful.

Coming now to a more particular description of the flora of this subalpine region, we refer the reader to former articles for the many species which, occurring first in the coniferous belt, extend into and often become more abundant in this, as well as for the few which, beginning below the coniferous belt, ascend above its limits.

In the following list Y, as heretofore, indicates a plane of the Yosemite Valley. W. indicates one of the Wawona valley, and M. G. one chiefly found in the Mariposa grove of big trees, while the other abbreviations also have the same meaning as before.

Thalictrum occidentale Gray. Borders of meadows.

sparsiflorum Turcz. Banks of streams, 7,000 feet and above.

Ranunculus Flammula L. var. reptans Meyer. Y. & C.
alismæfolius Geyer. Crescent Lake.
occidentalis Nutt. var. tenellus Gray. W.
Caltha biflora DC. Crescent Lake. A.
Aquilegia cærulea James. Y. Cultivated from native specimens.
Delphinium decorum F. & M. var. patens Gray. Crescent Lake.
Andersonii Gray. Upper Yosemite Creek.
scopulorum Gray, var. glaucum Gray. Buck Camp, 7,000 feet.
Aconitum Columbianum Nutt. Buck Camp. Upper Yosemite Creek.
Draba stenoloba Ledeb. Y. (Bot. Cal.)
crassifolia Graham. Peregoy's.
Arabis platysperma Gray. Dry slopes, 6,000 to 7,000 feet.
repanda Wats. Y. W.
Holboellii Hornem. Y.
Erysimum asperum DC. var. pumilum Wats. Crescent Lake.
Sisymbrium incisum Engelm. Cloud's Rest.
Nasturtium sinuatum Nutt. Y. W.
Subularia aquatica L. Crescent Lake.
Viola blanda Willd. Y. Crescent Lake.
glabella Nutt. Occasional, 6,000 feet.
Stellaria crispa C. & S. Y. Cliffs, etc.
umbellata Turcz. Buck Camp.
longipes Goldie. Everywhere.
Jamesii Torr. Y Frequent below 7,5 00 feet.
Arenaria capillaris Poir. Glacier Lake.
Calandrinia pygmæa Gray. A. Buck Camp, 7,500 feet and above.
Claytonia Chamissonis Esch. Frequent at 6,000 feet and above.
triphylla Wats. Frequent at 6,000 feet and above.
Spraguea umbellata Torr. Sandy soil but rare below 6,000 feet
Linum digynum Gray. Yosemite Trail (Bot. Cal.)
Geranium Richardsoni F. & M. Buck Camp.
incisum Nutt. Y. W. etc.
Ceanothus prostratus Benth. Rocks at about 6,000 feet.
Acer glabrum Torr. Yosemite cliffs.

Lupinus ornatus Dougl. Crescent Lake.
sericeus Pursh. Mts. Buena Vista and Surprise, 8,000 feet.
confertus Kell. Glacier Point Turnpike, etc. Y.
Andersoni var. Grayi Wats. W.
parviflorus Nutt. Y.
laxiflorus Dougl. Inspiration Point, etc.
minimus Dougl. Lake Tenaya.
Breweri Gray. Above Yosemite 7,000 feet. Crescent Lake.
Trifolium longipes Nutt. Peregoy's, etc.
Bolanderi Gray. Peregoy's, etc.
monanthum Gray. W. Glacier Point Turnpike.
Hosackia Torreyi Gray. W. 5,000 feet.
Astragalus Bolanderi Gray. South of Yosemite. 7,000 feet.
Spiræa betulifolia Pallas. Y., etc.
discolor Pursh. var. dumosa Wats. 7,000 feet.
Geum macrophyllum Willd. Y. W.
Fragaria Virginiana Ehr. var. Illinoensis Gray. Y.
Potentilla gracilis Dougl. var. rigida Wats. Y.
Grayi Wats. Peregoy's. Base of Mt. Hoffman, 7,000 feet.
gelida C. A. Meyer. Crescent Lake.
Horkelia fusca Lindl. Y. and above.
tridentata Torr. Y. W.
Ivesia unguiculata Gray. Y. (Bot. Cal.)
santolinoides Gray. South of Yosemite. 7,000 feet.
Pyrus occidentalis Wats. Crescent Lake, etc. 7,000 feet.
Saxifraga occidentalis Wats. Yosemite Cliffs.
bryophora Gray. Foot of Mt. Surprise, 7,500 feet.
Boykinia major Gray. Y. M. G.
Bolandra Californica Gray. Yosemite Cliffs.
Tellima tenella Walp. Yosemite Cliffs.
Mitella Breweri Gray. Peregoy's, etc., 7,500 feet.
Heuchera rubescens Torr. Yosemite Cliffs.
Parnassia palustris L. var. Californica Gray. Meadows. (Bot. Cal.)
Ribes oxyacanthoides L. Lake Tenaya.
lacustre Poir var. molle Gray. Lake Tenaya.
cereum Dougl. South of Yosemite.
viscosissimum Pursh. Yosemite Cliffs

Epilobium spicatum Lam. W., etc. 5,000 and 6,000 feet.
Watsoni Barbey. Cloud's Rest.
alpinum L. Summit Chowchilla Mountain, etc.
origanifolium Lam. Same region as last. A.
brevistylum Barbey.? W.
glaberrimum Barbey. Common at 5,000 and 6,000 feet.
Gayophytum racemosum T. & G. Frequent.
pumilum Wats. Signal Pk.
Sanicula Nevadensis Wats. 5,000 feet.
Carum Howellii C. & R. W. Snow Creek. 3,300 feet.
Eulophus (Podosciadium) Bolanderi C. & R. Yosemite Cliffs, etc.
Ligusticum apiifolium B. & H. Y. (Bot. Cal.)
Grayi C. & R. Crescent Lake, etc., 7,000 feet.
Cymopterus terebinthinus T. & G. Y., etc.
Garrya Fremontii Torr. Yosemite Cliffs, etc.
Lonicera conjugialis Kell. Glacier Point, Crescent Lake. 7,000 feet.
cærulea L. Crescent Lake
Kellogia galioides Torr. W. Frequent at 5,000 and 6,000 feet.
Galium bifolium Wats. Peregoy's, etc. 7,000 feet.
pubens Gray. Y. W. 5,000 feet.
Valeriana sylvatica Banks. Y. and above. A.
Eupatorium occidentale Hook. Mt. Buena Vista. Yosemite Cliffs. A.
Brickellia grandiflora Nutt. Y.
Chrysopsis Breweri Gray. Woods, 6,000 to 8,000 feet.
Aplopappus Whitneyi Gray. Wooded slopes, 7,000 feet.
cuneatus Gray. Rocks. Y. & C. 6,000 feet.
Bloomeri Gray. South of Yosemite. 7,000 feet.
Aster campestris Nutt var. Bloomeri Gray. Lake Tenaya.
adscendens Lindl. Y. Crescent Lake, etc.
integrifolius Nutt. Crescent Lake, etc. 7,500 feet.
occidentalis Nutt. Y. and W. Common, 5,000 feet.
Fremonti Gray. Yosemite region.
Andersoni Gray. South of Yosemite. Abundant on shores of subalpine lakes, 7,000 feet and above.
Erigeron salsuginosus Gray. Yosemite Cliffs. Crescent Lake. 7,500 feet.
Breweri Gray. W. Y. Below 6,000 feet.

Antennaria dioica Gaertn. Yosemite Cliffs, Crescent Lake, etc.
Rudbeckia Californica Gray. M. G.
Wyethia mollis Gray. Y. and above Lake Tenaya.
Madia Bolanderi Gray. M. G.
Hemizonella minima Gray. Above Yosemite. (Bot. Cal.)
Whitneya dealbata Gray. M. G., etc., 6,000 feet.
Hulsea brevifolia Gray. Y. and above.
Chænactis Douglasii H. & A. W. Y., etc.
Artemisia tridentata Nutt. Y.
  Rothrockii Gray. Crescent Lake. A.
Senecio lugens Richardson. Crescent Lake, etc.
  triangularis Hook. M. G. Common at 5,000 to 6,000 feet.
Arnica cordifolia Hook. Yosemite Cliffs.
  Chamissonis Less. Yosemite Cliffs.
  viscosa Gray. Base Cloud's Rest.
Phalacroseris Bolanderi Gray. South of Yosemite. 7,000 feet.
Stephanomeria lactucina Gray. M. G.
Crepis acuminata Nutt. Buck Camp. 7,500 feet. A.
Troximon Nuttallii Gray. Base Cloud's Rest.
Hieracium horridum Fries. (Breweri Gray.) 7,500 feet above Yosemite.
  albiflorum Hook var. flavum. Nevada Falls trail.
Vaccinium myrtillus L. Crescent Lake.
    var. microphyllum Hook. Same.
  occidentale Gray. South of Yosemite. 7,500 feet.
Arctostaphylos Nevadensis Gray. Not rare at 7,000 feet.
Leucothöe Davisiæ Torr. Signal Pk. 6,000 feet.
Kalmia glauca L. Crescent Lake, etc. 7,500 feet.
Ledum glandulosum Nutt. Chihuahua Creek. 6,500 feet.
Pyrola secunda Ait. Occasional above 7,000 feet.
Sarcodes sanguinea Torr. W. Common at 5,000 to 7,000 feet in the woods.
Pleuricospora fimbriolata Gray. M. G., etc.
Gentiana Amarella L. var. acuta Hook. Above Yosemite. (Bot. Cal.)
  simplex Gray. South of Yosemite, 7,000 feet.
  Newberryi Gray. Slopes of Mt. Buena Vista, 8,000 feet.
Frasera speciosa Dougl. Glacier Point.

Menyanthes trifoliata L. Crescent Lake.
Phlox Douglasii Hook. Above Yosemite, etc. 7,000 feet. A.
Gilia tenella Gray. South of Yosemite. (Bot. Cal.)
pungens Benth. Y.
aggregata Spreng. Above Yosemite, etc. 7,000 feet.
leptomeria Gray. Goose Lake. 6,500 feet.
Polemonium humile Willd. South of Yosemite. 7,000 feet.
Phacelia hydrophylloides Torr. Occasional at 6,000 feet.
pusilla Torr. Lake Tenaya.
Hesperochiron Californicus Wats. Peregoy's.
Mertensia Sibirica Don. Common at 6,500 feet, etc.
Echinospermum diffusum Lehm. South of Yosemite. 7,000 feet.
floribundum Lehm. Same region.
Collinsia Torreyi Gray. Y. Common below 7,000 feet.
Penstemon Menziesii Hook. Y.
confertus Dougl. Y. Also A. in dwarf form.
lætus Gray. Y. and above.
Mimulus leptaleus Gray. Glacier Point, Turnpike, etc. 6,000 feet.
Torreyi Gray. Not rare at 4,000 to 5,000 feet.
Lewisii Pursh. Chihuahua Creek, etc. 7,000 feet.
laciniatus Gray. Y. W.
rubellus Gray. Peregoy's.
n. sp. Glacier Point Turnpike.
mephiticus Greene. Glacier Point. Lake Tenaya. A.
primuloides Benth. Y. & C. 5,000 to 6,oco feet.
Veronica alpina L. Crescent Lake.. 7,500 feet.
Castilleia affinis Hook & Arn. Y. Crescent Lake, etc.
Lemmoni Gray. Lake Tenaya.
Orthocarpus lacerus Benth. Y. and above.
Pedicularis Grœnlandica Retz. Lake Tenaya.
attollens Gray. Crescent Lake.
semibarbata Gray. Forests at 5,000 feet.
Utricularia vulgaris L. Y.
Rumex paucifolius Nutt. Little Yosemite, Lake Tenaya.

Polygonum minimum Wats. Lake Tenaya.
ramosissimum Michx. Y.
tenue Michx. Y. and above.
Bidwelliæ Wats. Crescent Lake.
Bistorta. L. Y. and above.
polymorphum Ledeb. Glacier Point, Lake Tenaya.
Eriogonum stellatum Benth. Crescent Lake.
Torreyanum Gray. Crescent Lake.
incanum T. & G. Nevada Falls trail. 7,000 feet. A.
marifolium T. & G. Nevada Falls trail. 7,000 feet. A.
spergulinum Gray. Peregoy's, etc. 7,000 feet. A.
Wrightii Torr. Chihuahua Falls. 6,000 feet.
Myrica Hartwegi Wats. Banks of Big Creek. 5,000 feet.
Salix Sitchensis Sanson. Glacier Point Turnpike.
Lemmoni Bebb. Not rare at 4,000 and 5,000 feet.
Californica Bebb. Crescent Lake.
Populus trichocarpa T. & G. Y.
Castanopsis chrysophylla. A. DC. W., etc. 5,000 to 6,000 feet.
Phoradendron Bolleanum Eichl. Signal Pk., etc., on Abies concolor.
Juniperinum Engelm. Common on Libocedrus at 5,000 feet.
Arceuthobium Americanum Nutt. Little Yosemite on Pinus Murrayana.
Juniperus occidentalis Hook. Nevada Falls. Lake Tenaya.
Sequoia gigantea Decaisne. M. G.
Abies magnifica Murr. Glacier Point, etc. 7,000 feet.
Tsuga Pattoniana Engelm.
Pinus monticola Dougl. Not rare at 7,000 and 8,000 feet. A.
Jeffreyi Murr. Glacier Pt., etc. 6,000 to 7,000 feet.
Murrayana Balf. Y. and more common above 7,000 feet.
Habenaria leucostachys Wats. Brooks at 5,000 to 7,000 feet.
sparsiflora Wats. Summit Mt. Chowchilla, 6,500 feet.
hyperborea R. Br. Crescent Lake.
Goodyera Menziesii Lindl. Pine forests at 4,500 to 6,000 feet.
Epipactis gigantea Dougl. Chihuahua Creek. 6,000 feet.
Cypripedium montanum Dougl. W. Y.
Iris longipetala Herb. Y.

Sisyrinchium Californicum Ait.
Allium validum Wats. Buck Camp, Lake Tenaya. 7,500 feet.
Sanbornii Wood. Y. (Bot. Cal.)
bisceptrum Wats. Crescent Lake, etc.
tribracteatum Torr. Glacier Lake.
Camassia Leichtlinii Wats. Meadows, Glacier Pt. Turnpike.
Lilium parvum Kell. Y. and above.
Veratrum Californicum Durand. W. Crescent Lake.
Zygadenus venenosus Wats. Y. and above.
Sparganium simplex Huds. Crescent Lake, etc.
Potamogeton Claytonii Tuck. Y. (Bot. Cal.)
natans L. Crescent Lake.
Luzula spadicea DC. var. melanocarpa Meyer. Not rare at 6,000 feet and above.
divaricata Wats. Base of Mt. Hoffman.
Juncus Drummondii Meyer. Crescent Lake, etc. 7,000 feet. A.
Nevadensis Wats. Crescent Lake, etc. 7,000 feet. A.
oxymeris Engelm. W. M. G.
phæocephalus Engelm. Not rare, 5,000 feet and above.
obtusatus Engelm. Big Creek, 5,000 feet.
chlorocephalus Engelm. Y. Tenaya trail.
Scirpus carinatus Gray. Y.
sylvaticus L. var. digynus Bœckl. Buck Camp.
criniger Gray. Lake Tenaya.
Hemicarpha occidentalis Gray. Sandy beds of Merced and South Fork.
Eleocharis obtusa Schultes. Y.
Fimbristylis capillaris Gray. Y.
Carex filifolia Nutt. Nevada Falls trail, Lake Tenaya. 7,000 feet. A.
Douglasii Boott. Y. (Bot. Cal.)
Hoodii Boott. Y. (Bot. Cal.)
illita Bailey. Y. and above.
specifica Bailey. Yosemite region.
straminea Schk. var. congesta Boott. A. Above 7,000 feet.
athrostachya Olney. Y.
tenuirostris Olney. Lake Tenaya.
canescens. L. W. (Bot. Cal.)

Carex echinata Murr. Above 4,500 feet.
scoparia Schk. var. fulva W. Boott. Above 5,000 feet.
adusta Boott. W. and above.
quadrifida Bailey. Lake Tenaya.
Raynoldsii Dewey. Lake Tenaya.
globosa Boott. Yosemite Cliffs, etc.
amplifolia Boott. W.
Yosemitana Bailey. Y.
Whitneyi Olney. Y.
Sartwelliana Olney. Y.
luzulæfolia Boott. Crescent Lake.
fulva Good var. Hornschuchiana Boott. Y.
lanuginosa Boott. Yosemite region. W.
trichocarpa Muhl var. imberbis Gray. Royal Arch Lake.
vesicaria L. Y.
utriculata Boott. Royal Arch Lake.

Phleum alpinum L. Glacier Point. Meadows, etc., 7,000 feet. A.

Sporobolus depauperatus Scrib. Y.
gracillimus Vasey. Y. and above.

Agrostis æquivalvis Trin. M. G. (Bot. Cal.)
exarata Trin. Frequent above 4,500 feet. A.
varians Trin.? Mt. Buena Vista. A.
elata Trin. Y.
scabra Willd. Everywhere above 4,000 feet.

Cinna arundinacea L. Royal Arch Lake, etc.

Muhlenbergia gracilis Trin. Y. (Bot. Cal.) Lake Tenaya.

Vaseya comata Thurb. Y. and above.

Deyeuxia Canadensis Beauv. Royal Arch Lake.
Langsdorffii Kunth. Crescent Lake, etc., 7,000 feet.
stricta Trin. Yosemite region.

Stipa occidentalis Thurb. Frequent above 7,000 feet. A.
Kingii Boland. Lake Tenaya.

Danthonia sericea Nutt. Yosemite trail. (Bot. Cal.)

Trisetum subspicatum Beauv. Frequent. A. Above 7,000 feet.
var. molle Gray. Frequent. A. Above 7,000 feet.

Deschampsia cæspitosa Beauv. Crescent Lake. Lake Tenaya. A.

Melica stricta Boland. Yosemite Cliffs.
fugax Boland. Frequent above 6,000 feet.
Glyceria fluitans. R. Br. Y.
nervata Trin. Frequent above 4,000 feet.
pauciflora Presl. W., etc.
Agropyrum violaceum Lange. Upper slopes of the mountains. A.
Cheilanthes Californica Mett. Y.
Pellæa Breweri Eaton. Yosemite Cliffs.
densa Hook. Yosemite Cliffs.
Bridgesii Hook. Yosemite Cliffs.
Cryptogramme acrostichoides. R. Br. Yosemite Cliffs. Mountain slopes.
Aspidium Nevadense Eaton.

These species, 295 in number, of which only 21 are certainly known to extend above to the proper alpine heights, taken with the 39 species in common with the plains and lower foothills, and the 75 species which reach here from the coniferous belt, make a total of 409 native species, which constitute the entire proper flora of the district. Scarcely a trace of the naturalized plants of the lower regions here appears except in the cultivated grounds at Wawona and in the Yosemite, and no attempt is here made to take any account of them nor of some common plants that are limited to the cultivated fields and meadows in both valleys, and are as much introduced plants where they are found as the recognized weeds that grow with them.

## NOTES ON OTTERS.

BY SAM HUBBARD, JR.

### SEA OTTER (*Enhydris lutris*).

The coast of Washington from Gray's Harbor north to Cape Flattery is the only part of the United States in which the sea otter is now hunted outside of Alaska. This interesting and valuable fur bearer, unlike its cousin, the land otter, lives in the ocean, and is rarely known to come ashore. A full-grown sea otter is about as large as a setter dog, with a thick, chunky head, and a mouth full of formidable looking teeth. It has short fore legs, not over six or

eight inches long, terminating in soft, round paws, while instead of having hind legs like a land otter it has seal-like flippers, but unlike the seal the otter has a round tail about a foot long, covered with beautiful fur.

In color otters vary somewhat. The young are a rich brown; from this they change, in the adult animal, into a deep, glossy black, the more valuable skins being sprinkled with long white hairs, giving that silver-gray appearance which is so much prized. As they grow older the white hairs predominate, so that some of the largest skins will be grizzled gray all over, lighter on the belly and darker on the back. The skin is very loose, lying almost in folds, so that from an animal but little over three feet in length comes a skin which easily stretches to six feet and over. The fur is very thick and beautiful, and nearly an inch long, and has no full covering of thick, coarse hair, as in the case of beaver and land otter skins.

Mr. Damon, who lives on Damon's Point, which is the north spit at the entrance of Gray's Harbor, once caught a young otter which had wandered into the bay and become stranded on a sand spit near his house. He brought the little fellow home, provided him with a tub of water, and gave him all the care possible, but during the night he escaped from the tub and was found dead in the morning.

I also saw a cub that was killed by the Indians at the Quinault Reservation. It was brown all over, and the skin was worth about fifteen dollars.

Their principal food consists of clams and crabs, but they doubtless catch some fish also. They obtain their food by diving for it right in the edge of the surf, and it seems as though the heavier the breakers the more they enjoy the sport. When they catch crabs (which seem to form their principal diet), they come to the surface of the water, and, floating on their backs, place the crabs on their breasts and proceed to tear them to pieces with their short fore paws. The Indians also claim that they carry their young in the same manner. Many of the larger skins have a worn spot on the breast owing to its constant use as a table.

There are some large beds of kelp a few miles off the coast, and on these the young are born, usually two in number. Owing to the fact of these animals living all the year round in the cold waters of the North Pacific, the fur seems to be just as good in the summer as it is in the winter.

They are hunted by both white men and Indians, who shoot them with heavy rifles especially manufactured for long-range purposes. This is probably the most difficult rifle shooting in the world, the successful hunter requiring extraordinary skill and vast patience, plentifully sprinkled with good luck. In the first place the otter is very shy, and all shooting is done at from two to six hundred yards. Then the otter merely shows his head and a small portion of his hips, which makes a very small mark at that distance. Again he rarely approaches shore except in rough weather, so that he is always bobbing up and down on the big rollers, and usually with a high wind blowing. With all these difficulties to contend with it is no wonder that several hundred shots are fired to each otter obtained, and also that from two to four otters are considered a good year's work. The price of skins on the beach ranges from $50 to $250 each according to size and quality, the average being somewhere near $125. Twenty or thirty years ago the otters were much more plentiful than at present, bands of several hundred being seen at a time, and in those days the hunter would get as many in a month as he now gets in a year, but at the same time the price of the skins was about half what it is at present.

When the white men first began to make a business of hunting otter in the palmy days of old, when they were plentiful, they selected spruce trees which stood conveniently close to the water, and constructed platforms in them about twenty or thirty feet from the ground. From these elevated stages they could overlook the surf and discern their game much more readily than from the beach. As the otters became wilder and kept farther away, the necessity for something better presented itself, so they constructed what are known as derricks, made of three long poles set up like a tripod and surmounted on top by a small wooden box open at the top and one side. These derricks are set up on the beach about half way between high and low water, the box, or crow's nest, standing about twenty feet above the sand.

The hunter enters this as the tide is coming in, so that at high water he is on an elevated perch right in the midst of the breakers. He is kept a prisoner there, however, until the tide recedes sufficiently to allow him to go ashore. If he is fortunate enough to kill an otter he makes a note of the condition of the tide, the force and

direction of the wind, the drift of the current, etc. Then he patrols the beach in the direction in which the otter is liable to come ashore, and patiently waits for it to come in. This sometimes takes two days, but they all of them come ashore sooner or later. He also tells his comrades, who likewise watch the beach, and they always respect each other's property. When hunters were more numerous than they are at present they used to brand their bullets as an additional means of identification.

In the summer season when the weather is settled the Indians of the Quinault Reservation venture out into the ocean in their canoes and attack the otter out at sea. The white hunters object strongly to this method of hunting, as they claim it makes the otters even wilder than they are at present. Undoubtedly many otters are hit that get away badly wounded. This is particularly the case when pursued by the Indians in their canoes. They are not as good shots as the white hunters, and then they often find bands of otter and shoot indiscriminately into the bunch.

Probably the most successful white hunter on the beach is a man named Wetherell, who has hunted there a long time and has killed a great many otters. About half way between Gray's Harbor and the Quinault River is the Copalis Rock, which stands in the ocean some 600 yards from the beach. This rock has very precipitous sides and its summit is perhaps forty feet above the water on a calm day, but when there is a storm the great rollers come in and dash themselves against this bold sentinel until the spray runs in snowy cascades down his grim sides and the shock of the impact makes him tremble to the very foundation. On this wild spot Wetherell determined to build a house and shoot sea otter—and he did it.

The rock can only be approached in calm weather, so with the aid of some Indians and their canoes he carried lumber out there and built a small hut on the highest point of the rock and securely bolted it down. He carried out food and water and here he used to stay, sometimes kept prisoner for three or four weeks at a time, but enjoying magnificent opportunities to shoot otters as they swam by. He established a code of signals and also had a blackboard on which he used to write the direction a dead otter was drifting. This was read by means of a glass by his confederates on shore, who picked them up as they drifted in. This was a very successful stand for a

long time, until they shot there so much that the otters became alarmed and have ever since given the rock a wide berth. The otters have other enemies as well as man. This was demonstrated to my satisfaction by finding on the beach a dead one that had been killed at sea. It had several long cuts in the skin and a great bruise as though it had been bitten by some large animal. The otter hunters said that it had probably been attacked by a shark or a sea lion while lying asleep on the water. The otter probably had strength enough to escape from its assailant, but finally succumbed to its wounds. There was a peculiar crease on one of the hind flippers, which, on skinning, proved to be an old bullet wound, as small pieces of lead were found imbedded in the bone.

The otter was quite fat and perfectly fresh when found. The fur was glossy black, changing to dark brown underneath. The skin was bought by a trader and fur buyer, who paid $65 for it.

NORTH AMERICAN OTTER (*Lutra canadensis*).

Quinault Lake is in that forest wilderness that borders the Pacific Ocean in the extreme western part of the great State of Washington.

The lake is about fifty miles north of Gray's Harbor and some thirty miles east of the ocean, and is drained by a fine river of the same name, timbered along its shores by firs, hemlocks and cedars.

It is only within the last five years that this interesting country has been explored by white men, consequently wild animals are still tolerably abundant and may occasionally be seen in their native fastnesses.

One beautiful evening in August I sat in my canoe about a quarter of a mile down the river from the lake and just above the first rapid. The shadows had grown quite long, the millers and caddis flies had come out of their leafy retreats and were flying over the stream, while the eager trout were breaking water and exposing their silvery sides with a recklessness that made my fisherman's heart beat stronger. The last fly had been fastened on the leader and I had just seized the pole to push into the stream when some animals on the opposite side of the river caught my eye. The first thought that flashed through my mind was muskrats. No, they are too active for muskrats; then they must be mink; too large for mink; they were otters. What a good time they were having too!

Fortunately the rifle was in the canoe, so I paddled quietly across

the stream, being careful to keep above them. The wind was blowing up stream from them towards me, so they did not scent me and appeared entirely unsuspicious.

I was now within fifty yards of them; so as quietly as possible I laid down the paddle and, picking up the rifle, let the boat drift. The current carried me rapidly toward the otters and I was just about to shoot when the canoe quietly grounded on a submerged rock and hung poised in mid stream. I was now within thirty yards of the game and had an unobstructed view of all their movements.

There were six of them in all, four pups and two adults. They were diving for fish and each one that went down came up with a trout in his mouth. He would then gulp him down without going ashore, and at once dive for another. Their heads sticking above the water, their mouths wide open, with the white of their lips and gums showing, reminded me of a lot of rubber tubes.

There was a moss-covered root sticking out of the water near by, and every now and then a couple of the pups would climb out on this and chase each other and play like two kittens.

While I watched them they caught six or eight trout from four to six inches in length, bolting them down with evident relish.

All this time, however, the current was taking the older ones, who seemed to do most of the fishing, further down the stream. This was a reminder that it was time for me to take a hand in the game. I waited until two of the pups crawled out on the root, and drawing down as fine as possible on one of them I pressed the trigger.

Between those forest walls the roar of the gun sounded like a small cannon. For a few seconds there was a great splashing and commotion and then all was still. Not an otter was to be seen. I had apparently missed a dead shot. Impelled by a vicious shove from the setting pole, the canoe shot alongside the root, and there, struggling in the water behind it, was a fine young otter with a bullet hole through his head.

Otters sometimes follow down the streams of this region into tide water. An old trapper once showed me an otter slide on the muddy banks of the Hoquiam River not two miles from Gray's Harbor, the river at this point being a slough in which the tide ebbs and flows. The slide was very faintly indicated and I should never have known what it was if he had not pointed it out to me. Young otter are readily tamed and make most interesting and pretty pets.

# THE EFFECT OF CLIMATE UPON PACIFIC COAST BIRDS.

BY L. BELDING.

It has been the custom of American ornithologists to refer to the birds of the damp forests on the coasts of Northern California, Oregon, Washington, and British Columbia as the "dark, northwest coast birds;" of the birds of the arid treeless areas east of the Cascade and Sierra Nevada Mountains, of the Mojave and Colorado deserts and Arizona, as the "bleached desert races;" of the resident peculiar forms of the Sacramento and San Joaquin valleys, as birds of the "dry, hot interior," thus referring to localized forms, which migrate little, if at all, and in the terms quoted, correctly conveying the idea that the environment or climate inhabited by these forms is the cause of their divergence from nearly related species and sub-species. A familiar axiom carrying the same idea is, "Migration holds species fast, localization lets them slip," the purport of which is that birds which migrate and are subject to many conditions are much less liable to change than those which do not migrate and are subject to few conditions. Whatever potency natural selection or sexual selection may have in causing differentiation—and their operation in this direction seems very obscure—here, where there is such variety of climate, soil, and vegetation, consequent upon difference in altitude and humidity, proximity to the ocean and removal from it, we may well consider climate as our most important factor in evolution.

Turning from birds to man, we see in our country, descendants of people of various European nationalities who bear the impress of our climate and the distinctive characteristics of Americans. Even the pure-blooded Jew, whose occupations and modes of living vary but little, is similarly affected, and I have noticed that the English Jew resembles, more or less, the Englishman, the German Jew the German, and I think the Polish Jew is different from any of these. It is difficult to see how selection could have had much influence in modifying the Jew.

The black man appears to be one of the natural products of Africa, the copper-colored man of America, but I would not venture to predict that the Caucasian and negro of America will in the dim future become copper colored, and that our vexatious race problem will in this way be solved, but I do venture to protest against giving the theory of selection undue prominence.

# A NEW JUMPING SPIDER.

BY JOHN L. CURTIS.

The subject of the following description is a spider which has been carefully studied by the writer for some time past. It was recently submitted to Prof. G. W. Peckham, who has pronounced it a new species of the genus Dendryphantes. Accordingly, I have thought it timely to publish a short description of the spider, together with such notes on habits, etc., as I have collected. The following will, I think, sufficiently identify it.

## DENDRYPHANTES ÆNEOLUS.

Total length, 5.4 mm.; width of abdomen, 2.2 mm.

Cephalothorax, length, 2.4 mm.; width, 2.2; height, 1.8 mm.

Legs, 8.3 mm., 5 mm, 4.6 mm., 6.2 mm. Patella and tibia of the first, 2.7 mm.; patella and tibia of 2d, 1.6 mm.; patella and tibia of 3d, 1.6 mm.; patella and tibia of the 4th, 2 mm.; metatarsus and tarsus of the 4th, 1.6 mm.

Total length, 6.7 mm.; width of abdomen, 2.6 mm.

Cephalothorax length, 2.6 mm.; width, 2 mm.; height, 1.6 mm.

Legs, 6.2 mm., 4.9 mm., 4.4 mm., 5.9 mm. Patella and tibia of 1st, 2 mm.; patella and tibia of 2d,.1.6 mm.; patella and tibia of 3d, 1.2 mm; patella and tibia of 4th, 1.8 mm.; metatarsus and tarsus of 4th, 1.7 mm.

♂♀Cephalothorax moderately high, convex, a very little dilated behind dorsal eyes with sides nearly vertical in front and rounded behind. Ephalic part level, thoracic part falling rather abruptly. Quadrangle of eyes occupying one-third of cephalothorax, one-half wider than long, same width before and behind. First row of eyes bent, inclined slightly downward, middle eyes sub-touching, lateral about one-third as large as middle eyes and separated from them by one-fourth of their own diameter. Eyes of second row midway between dorsal and lateral eyes ♂, a little farther from dorsal than from lateral eyes ♀. Dorsal eyes a little smaller than lateral eyes, farther from each other than from lateral borders, forming a row as wide as the cephalothorax at that place. Clypeus perhaps inclined a little backwards, one-third as high as middle eyes in ♂, four-fifths as high as middle eyes in ♀. Falces wider than the two middle eyes, reaching to inner margins of lateral eyes, once and a half as long as face ♂♀, divergent, inclined slightly forward. Fang strong ♂, vertical, paral-

lel; fang weaker ♀. Maxillæ blunt, cut on inner margin toward labium. Labium a little longer than wide, more than one-half as long as maxillæ; sternum oval, three-fourths longer than wide, projecting between anterior coxæ. Anterior coxæ separated by a little more than the width of the labium, much larger and longer than the others, smaller and shorter in ♀ than in ♂. Legs of first pair much larger and longer than the others ♂, somewhat larger and longer than the others ♀. Femoral joints compressed and enlarged. A few spines on femur, patella, tibia and tarsus and metatarsus of first leg, all but the patella of second, third and fourth legs, in terminal ring on tarsus of third and fourth. In the first and second pairs the spines are most numerous on the inner side of the leg. A few femoral spines on the palpi.

### COLORATION.

FEMALE.—Upper cephalothorax grayish-brown with slight bronze cast and a space of polished black posteriorly just in front of the abdominal juncture. Under side black with long white hairs sparse.

The background color of upper abdomen is black or deep brown, with a heavy bronze cast over all. Beginning at the spinnerets and extending about four-fifths of the abdominal length, are two narrow, black or deep brown bands. Between these bands anteriorly is a light, tawny-yellowish area divided centrally by a dark streak. More of this yellowish color is seen along outside the bands and on the forepart of the abdomen. There is a border of the same around the anterior rim. Upon each of the black bands are four spots of the same. Side abdomen light gray, under side same, darker along the median line.

MALE.—The upper cephalothorax is usually black or has the gray-brown color only in patches. The chief difference is in the upper abdomen, which has the same ground-color and bronze cast but no yellow markings except the anterior and side rim. The bands are obliterated, but often the posterior yellow spots remain.*

### EXPLANATION OF MARKINGS.

The gray-brown color of the cephalothorax is due to short, stout, slightly iridescent yellow scale-hairs scattered over the black integu-

*The foregoing description was made with a lens of a power of four or five diameters. The following was made with a compound microscope of about fifty diameters.

ment. The side color is due to the same scales and the black line along the rim is due to the absence of them. The yellowish clypeus is caused partly by long hairs and partly by scales. In the male the coloring of the clypeus is not so clearly yellow because the hairs and scales are sparser. In the upper cephalothorax these yellowish scales are interspersed with other scale-hairs of like shape but of a grayish color and most brilliant iridescence, which are particularly numerous on the forepart and produce the bronze luster. In some, especially in young specimens, these scale-hairs are thick all over.

The skin color of the upper abdomen is deep brown or black, usually appearing brown to the eye but under the microscope black with long black hairs. The yellow markings are formed of hairs like those on the cephalothorax, while the longitudinal dark bands are simply parts of the dark integument set in relief by the yellow scale-hairs. The yellow along outside of bands is in natural females a close collection of these scales, but in gravid females it appears as a series of oblique, backward streaks, one from each of the dots on the bands. This indicates weak portions of the integument, which stretch to make room for the eggs. Bronze hairs also, like those on the cephalothorax, are thickly set between the bands posteriorly, outside the bands anteriorly, and on the forepart of the abdomen. Others are scattered among the yellow hairs. The yellow border in both sexes is composed in part of longer hairs than those forming the other markings. The dark upper abdomen of the male is due to the absence of yellow scale-hairs, although there are enough bronze scale-hairs to give it a luster. The under abdomen has the same black skin covered with nearly white scale-hairs of a smaller size than the yellow ones. They are not so thickly set along the middle and the skin shows through, forming the darker central band. Male legs dark brown with darker brown rings, as follows: Last half of femur dark brown with tip end lighter; last end of tibia gradually darker; light scale-hairs on all except first two joints. The second pair of legs have dark rings on patella, tibia and tarsus; metatarsus with a black tip; scales as in first pair; third and fourth pair same. Palpi light brown, last joint dark, dark hairs on last joints, light hairs on others; light yellow scales on femur and two succeeding joints; mouth-parts, coxæ and sternum dark brown; anterior coxæ darker than posterior; falces nearly black; fang red-brown.

Female, first and second leg of a uniform light-brown with a black tip, light and dark hairs, sparse scale-hairs on all except first two joints. Third and fourth legs same with tarsus and metatarsus lighter. Some have a narrow dark ring on tibia of the third and fourth pairs; others have a dark ring on patella, tibia, and tarsus of the same. Palpi light-brown with light hairs.

The markings of this spider often rub off, giving rise to individual differences.

This brilliant bit of a spider is quite common about San Francisco Bay, but has not yet been reported elsewhere. It is found on many plants, but in gardens where I have observed it most, it is more frequently seen on honeysuckle, rose bushes, live-oaks, and the shrub known as laurestina. The last two seem to offer peculiar advantages, for not only do the leaves lie closely together, but the oak leaves are curled and the laurestina leaves are quite often rolled lengthwise. Between two leaves in the one case, or within the rolled leaf in the other, the spider finds a safe retreat, while the dead live-oak leaves, where they lodge together in hollows, furnish spacious cavities between them for the web domiciles.

The domicile is a simple flat tube, open at both ends, with sometimes an open branch tube from the main one. The spider enters by inserting the fore legs between the sheets of webbing and holding them apart as it forces its way in. If there is danger of intruding foes, the spider holds the sheets together with the fore legs at the end most threatened.

The flat cocoon which contains the yellowish eggs is made within the tube, and the young ones share the parent domicile until after the second moult, when they depart on aeronautic tours of exploration for themselves.

The males and females appear as adults as early as April, but the former become rare after the first of June and the latter after the first of September. The females begin laying eggs in May. The number of cocoons made by a single female is not more than two, and probably, judging from captives, the general rule is to make but one. The eggs, about fifty in number, hatch on the average in about twenty-five days, and the young are found at all times of the year.

DENDRYPHANTES ÆNEOLUS is one of our so-called flying spiders, the young being especially given to that progressive method of loco-

motion. Often, when sitting in the garden, I have had one alight on my book, crawl to the top of my uplifted finger or pencil, and fly away on its web or make it a bridge to some other and usually higher point. The way of getting upon the breeze is in principle the same as with all other flyers. Arrived at the top of an elevation, the spider raises the spinnerets and emits a thread, which the wind is allowed to carry far enough to bear. If this is successful, it flies, but if the thread catches, it simply fastens it where it stands, draws it in, as it were hand over hand, until taut, and then crawls upon it to the other attachment. In most cases the fly-line flows from the posterior spinnerets, while from the anterior pair another thread is drawn, and fastened to the point upon which the insect stands, so that it has a returning line if the flying, at first successful, should afterward end in failure. If the fly-line catches, the extra line simply strengthens the first end of it, or affords return, should it break.

It can easily be seen that this way of traveling must be exceedingly advantageous to these spiders, not only because of the ease and speed which the web bridge allows, in crossing water, desert places, patches of grass or clover and other obstructed routes, but also because of the much greater speed and safety afforded by actual flight. With spiders, as with men, however, the easiest and speediest ways are most likely to be disastrous, as is shown in the following instance, which illustrates as well the instinctive endowment enabling this spider to overcome its natural enemies.

On a bright morning several years ago a pet lizard lay sunning himself on a table in the yard, when a partly grown specimen of this spider came sailing along and dropped down directly in front of him. For a second or two the spider, unconscious of the great impending danger, looked about in the seemingly intelligent way peculiar to Attidæ. The lizard, as yet sluggish and unawakened, was pushed toward it. Instantly the careless attitude of the spider was changed for the strategic; facing its enemy, it slowly, almost imperceptibly, drew in its legs until it looked more like a tiny chip or the top of a polished nail-head than like a spider. The saurian was then moved around behind; *æneolus*, with fixed eyes and cautious movements, turned to face him still. I put my fingers just behind the spider, but it chose to face the greater, and, from the spider standpoint, more imminent foe, and kept its eyes on the lizard. After testing in various ways without touching it, I now slightly pushed

the spider from behind with a pencil. With a sudden side jump and a rapid dash along beside the lizard, it crawled under his outstretched tail and dropped over the edge of the table into the grass. If the lizard had been lively, the spider would not have fared so well, but as it was, it not only escaped, but had more scope for showing its instinct. In the first place, instinct seemed to tell that lizards are dangerous animals. That is curious enough in itself. In the second place, it had learned, or secured by inheritance, the exact strategem which could save it from such enemies, if anything could. A lizard never devours an insect that does not very perceptibly move. A third conclusion that I drew was that the spider knew which was the most dangerous end of the reptile. At any rate, it ran under the tail, and, though in a decided hurry, seemed to feel safer out of range of the lizard's eyes than in running straight on to the other end of the table. Making due allowance for any imagination of mine on the last point, it must be conceded that such knowledge of lizard habits in a spider shows considerable intelligence.

## NOTES ON HISTERIDÆ OBSERVED IN SAN DIEGO COUNTY.

BY F. E. BLAISDELL.

HOLOLEPTA. This genus is represented by six well-defined species, two of which I shall describe as new. The individuals of each, with two exceptions, are quite numerous in their season.

HOLOLEPTA YUCATECA Mars. Found in the decaying fruit of *Cucurbita*, *Echinocactus viridescens*, leaves and stalks of *Opuntia occidentalis*. The largest species of the genus, body greatly depressed, head extended, with long, prominent mandibles. Mentum flat, impunctate; prosternum narrowed, and rounded at tip; sides of body more or less arcuate. Rather plentiful from May to November.

HOLOLEPTA PERVALIDA sp. nov. Form strongly oblong, narrower and much less depressed than *yucateca;* sides parallel. Mentum nearly flat, strongly punctate laterally, rather sparsely so at middle; prosternum intermediate between the preceding species and

*fossularis;* mandibles rather strongly curved and shorter. Length 17.5 mm. Rare. Found in decaying *Echinocactus viridescens.*

HOLOLEPTA CACTI Lec. Very abundant in decaying cacti, frequently taken from beneath the bark of decaying and water-soaked wood of the willow. Mentum concave, with strongly elevated lines; prosternum narrowed and almost acute at tip.

HOLOLEPTA VICINA Lec. Common from July to November. Found in the decaying fruit of *Cucurbita.* Mentum concave without elevated lines; prosternum slightly narrowed, truncate, and slightly emarginate at tip.

HOLOLEPTA NEGLECTA sp. nov. Narrower and more elongate than *vicina.* Mentum feebly concave, lines rudimentary; prosternum slightly narrowed, subtruncate. Sides of prothorax quite evenly arcuate. Sides of body moderately arcuate. Length 7 mm. Found in decaying squashes. Rare. This species was identified for me as *lucida,* but is entirely different in habitat from specimens subsequently obtained of that species.

HOLOLEPTA POPULNEA Lec. Taken from decaying cacti in the eastern or desert portion of the county; common in Arizona.

HISTER SELLATUS Lec. Not common; in spring and early summer observed flying about sandy places near streams, also found about the roots of plants. Elytra are marked with red.

HISTER SEXSTRIATUS Lec. Common; observed flying about on warm days in spring, also found at the roots of grasses and beneath bark in rotten wood; a large black species.

HISTER MILITARIS Horn. In some seasons quite common. Frequents the sandy banks of streams, and beneath débris in same locality. Smaller species with each elytron marked with a red line.

TRIBALISTER MARGINELLUS Lec. Rare; taken from beneath rocks in moist places.

TRIBALUS CALIFORNICUS Horn. A very small species and abundant beneath bark, rocks, etc., in permanently moist places. I once observed some six or eight individuals feeding upon a living *Melanotus longulus.*

PAROMALUS OPUNTIÆ Lec. Common; found in decaying fruit of species of *Cucurbita,* leaves and stalks of *Opuntia occidentalis.*

PAROMALUS CONSORS Lec. Common; frequents decaying vegetable matter.

SAPRINUS OREGONENSIS Lec. Common about fetid vegetable and animal matter.

SAPRINUS LUBRICUS Lec. and S. FRIMBRIATUS Lec. Abundant everywhere, especially along the seashore about putrefying matter.

SAPRINUS CÆRULESCENS Lec. Quite common in summer about the dead bodies of snakes and small mammals.

SAPRINUS SULCIFRONS Lec. Common along the seashore beneath kelp.

## VIEWS OF A WORKING BOTANIST ON THE NEW AMERICAN RULES OF NOMENCLATURE.

BY J. H. CONGDON.

Five of these rules are simply the practice of all good botanists concisely expressed, and need no comment. No. VIII will never be followed. It is simply an extravagant but logical extension of the principle so rigidly expressed in rule No. 1.

The sooner No. 4 falls into a state of innocuous desuetude, the better. It will certainly get there.

As for No. 1, in the rigid construction that will be claimed for it, it is a deliberate sacrifice of the rights of the great majority of us to the vagaries of individuals. Where all the botanists of a country have for a generation agreed on the use of certain names for the vegetation of their own country, and everyone has learned them and become familiar with them, we do not intend to suffer some old pamphlet to be dug up by some musing bookworm from some pile of forgotten rubbish in some back closet in some old library three thousand miles away, where some old pedant has given a vague description from some traveler's scrap of a plant which the author never saw growing and really knows nothing about, to make all the rest of us take up our botanical lists, which have become as familiar to us as our alphabet, and rub out the old names associated with years of study and observation in the field, and put in their miserable resuscitated antiquities. We shall do nothing of the kind. We shall stick to the old familiar words and leave the works of those that adopt these new-old names to repose in the antiquated dust from which they were dug.

# SOME NOTES ON AZOLLA.

BY DOUGLAS HOUGHTON CAMPBELL.

One of the most interesting of the native Pteridophytes of California is the widely distributed *Azolla filiculoides*, occasionally called "water-fern." This pretty little plant is common in many localities, and when found at all, usually occurs in great numbers, and often covers extensive stretches of quiet water with a dense purple-red mantle so thick that the water is completely hidden. Sometimes, however, a pond that is completely covered with the plant, may, after a few months, show no trace of it beyond a few decaying fragments that have sunk to the bottom, or are entangled among the Lemna and other floating weeds on the surface. Whether this sudden disappearance is due simply to the plant's having completed its natural term of existence, or to some other cause, I am unable to say. A pond near the La Honda road, some dozen miles back of Palo Alto, was visited repeatedly between November 1891 and May 1892, and at all times was covered with a luxuriant growth of Azolla. The same pond visited in September, showed not a single living plant, although ripe spores were found in the decaying masses of plants at the bottom of the pond, and these germinated promptly when set free and placed in clear water. The pond has not been visited since, so I cannot say whether or not a new generation of plants has appeared.

The genus Azolla is a small one, but widely distributed. Of the four species usually recognized, two are American, viz.: *A. filiculoides* and *A. Caroliniana*; *A. nilotica* is African, and *A. pinnata* is Asiatic and Australasian. Both *A. filiculoides* and *A. Caroliniana* are attributed to California, but all specimens yet seen by me have belonged to the former species, and as these included some from the collection of the Academy of Sciences labeled *A. Caroliniana*, I have some doubts about this species occurring here. This is the species of the eastern part of the continent, where it is widely distributed and reaches as far south as Brazil. *A. filiculoides* occurs in Chile and Peru, and probably pretty much all along the Pacific Coast.

As the life history of all the species was very imperfectly known, an effort was made to clear up as far as possible the obscure points. To this end observations were begun in November, 1891, and continued, with more or less interruption, for a year. Only a few of the more important and general points brought out by these investi-

gations will be given here, as the details will be given in a somewhat extended paper that has just been completed.

The plants multiply very rapidly by the detachment of branches at the base, which become independent plants, and in this way the plant spreads with great rapidity when once established. Besides this method of multiplication, spores are formed which give rise to a new generation of plants.

The spores are of two kinds, large ones (macrospores), and small ones (microspores). The sporangea that contain these are borne in separate receptacles, which usually occur in pairs. These are borne on the lowest leaf of a branch, and an investigation of their earlier stages shows that they are metamorphosed leaf-segments. The ordinary leaves are divided almost to the base, into two lobes, and in the sporiferous leaves, one of these lobes is transformed into the rudiments of the sporocarps. This lobe is first divided into two equal parts by a median cell wall, and each half then grows by an apical cell to form the rudiments of the young sporocarp. At a very early stage a ring-like wall is formed around the base of each rudiment, and rapidly grows until it forms a cup, in which is contained the papilla-like sporangial receptacle. This cup finally closes at the top and thus forms the closed capsule in which the sporangia are borne. In the smaller sporocarps a single macrosporangium, which almost completely fills it, is formed, and this originates directly from the apical cell of the sporocarp-rudiment. The microsporangia are produced many together, and the sporocarps containing them are larger. The development of the two sorts of sporangia is at first much the same, and follows closely that of the ordinary ferns, so much so, indeed, as to leave no doubt that Azolla is closely related to them.

A comparison of the whole sporocarp with the sorus of certain ferns shows that its wall is really homologous with the indusium of the latter.

If we examine the earlier stages of the macrosporangium we cannot fail to be struck with its extraordinary resemblance to the young ovule of many phanerogams, and the form and position of the indusium suggest immediately its homology with the first integument of the ovule. This is not so surprising when we remember that the ovule is really nothing but a specially modified sporangium.

Up to a certain point the two kinds of sporangia develop alike, but a difference becomes evident just before the formation of the spores.

In the macrosporangium but eight spore mother cells are produced, while in the microsporangium there are sixteen. In both cases, each spore mother cell divides into four, in the usual way; but whereas all of these develop more or less perfectly in the microsporangium, only one comes to maturity in the macrosporangium, and develops into the single large spore that fills its cavity.

Shortly before maturity the protoplasmic matter filling the microsporangium separates into several masses (massulæ) each of which encloses a number of spores. The substance of the mature massulæ has a peculiar foamy appearance, and looks almost like a cellular tissue, but examination shows that it is only hardened protoplastic matter, and that the peculiar cellular appearance is caused by vacuoles in it. In stained sections of the nearly ripe sporangium, the nuclei of the disorganized tapetal cells can still be seen lying in the spaces between the massulæ, and are evidently concerned in the formation of the glochidia, curious anchor-like outgrowths of the massulæ.

In the macrosporangium the protoplasmic matter surrounding the spore is used to build up the curious epispore and appendages. The epispore in *Azolla filiculoides* is composed of a substance very similar to that of the massulæ. It is provided with prominent irregular knobs that have attached to them numerous fine threads. The upper part of the spore is crowned with three pear-shaped masses of the same substance as the epispore. The ripe macrospore fills the sporangium so completely, and the latter fits so closely into the indusium, that its wall is so compressed as to be only discernible after close scrutiny.

The sporangia are set free by the decay of the indusium, but this decay is only partial in the case of the macrosporangium, and the upper part of the indusium becomes hard and dark-colored, and persists as a little cap, covering the top of the spore, whose base finally becomes entirely free by the decay of the sporangium wall. As the massulæ escape from the microsporangium, by the complete disorganization of its wall, the glochidia stand out from them and by their hooked ends become fastened to the threads that cover the prominences on the surface of the macrospore, and often the massulæ are so numerous as to completely hide the lower part of the macrospore. This is obviously a great assistance in fertilization, as the germinating microspores are thus brought close to the macrospore.

In order to study the germination of the spores, sections must be

made, as the first stages take place within the completely closed spore. From the macrospore a small triangular prothallium is produced, which breaks open the apex of the spore, and pushes up between the three appendages on the top. A single archegonium is formed at a very early stage, in the center. This resembles in its essential features the archegonium of the ordinary ferns. In case the first archegonium is not fecundated, several others may be formed, but the growth of the prothallium is limited, and appears to cease after the reserve fund in the spore is used up. If the first archegonium is fertilized, the egg-cell after secreting a cellulose wall about itself divides by a transverse wall. From the upper of the two primary cells the stem and fine leaf of the young plant arise; from the lower, the primary root and the foot (the organ by which the embryo absorbs its nourishment from the spore).

The microspore produces an extremely simple prothallium bearing a single antheridium.

The ripe spores sink promptly when placed in clear water, but as the embryo develops, large intercellular spaces are formed, which, filling with gases, cause the young plant to rise to the surface.

The development of the prothallium, so far as could be determined, is completed in about one week from the beginning of germination; and it is almost as long before the young plant rises to the surface of the water. These figures are necessarily only approximate, as there is no means of telling how far germination has advanced without killing the plant, and there is a great deal of difference in the time when germination begins.

All species of Azolla have always associated with them a nostoc-like plant of the genus Anabæna. The necklace-like chains of cells of this plant are always found tangled about the growing point of the Azolla stem, and as the leaves develop, a cavity is formed in each one, into which the Anabæna filaments creep and form a colony. They do not seem to affect the growth of the Azolla, but are simply sheltered by it. As the sporocarps are forming, the Anabæna makes its way into the open top where the cells enter a resting condition to assume growth again when the spores germinate. When this takes place, the Anabæna filaments surround the growing point of the embryo, which is thus brought into contact with the parasite from the very first.

# NOTES CONCERNING THE FLORA OF SONORA.

BY T. S. BRANDEGEE.

Early in May the writer landed at Guaymas, the seaport of the State of Sonora, Mexico. This month of the year is never a good one for observing the vegetation of the region, for the ground has completely lost the moisture acquired during the rainy season, and no new showers are to be expected immediately. The time of my visit was unusually unfavorable, for the rainfall of the preceding rainy season had been small, and the vegetation of a dry earth under a burning sun showed fewer signs of life than usual. The surface of the country about Guaymas is very much diversified and eminently suitable for a varied flora; the city itself is almost surrounded by high cliffs and steep hills; the large harbor contains many islands, some rocky and abrupt, some of a more gentle and rolling character, and some extending into long sand-spits, but slightly elevated above high tide. Its waters find their way into numerous small bays, situated behind ridges and extending to the openings of long cañons, all of which can easily be visited by obtaining the assistance of the clamorous boatmen. Any botanical collector who reaches this place is likely to be visited by the same thoughts that often occurred to me when, after climbing a high hill, I saw from the shade of some rock the exquisite panorama spread out before me, and pictured the glorious time Dr. Edward Palmer must have enjoyed, when, climbing the rough hills covered with vegetation, crawling among rocks steaming from recent rains, and sailing around and about the islands and neighboring shores, he so carefully collected a flora then almost unknown and abounding in species new to the scientific world. A few plants were found, however, that do not seem to have been before noticed. One, that disagreeable bush *Atamisquea emarginata*, was seen on the hills near the coast, and as later it was often met with in the neighborhood of Hermosillo, it must be a common plant of this part of Sonora. *Helianthus dealbatus*, in a depauperate form, was found growing on one of the long sand-spits, and as its habitat was supposed to be the seashore sands between San Quentin and Magdalena Bay, this locality considerably extends its range. *Palafoxia linearis* also grows in sandy locations, and in saline soil near tide water bushes of *Avicennia nitida* are sometimes seen.

The cacti of the vicinity of Guaymas seem to have been somewhat neglected and are not noticed in the accounts of its flora. Of course they are difficult plants to make into botanical specimens, and disagreeable to come in contact with, but some of them, when in bloom, are very attractive, and there is a species of Platopuntia, often growing among nearly black rocks that contrast so strongly with its bright red joints as to make it seem from a distance like a mass of brilliantly colored flowers, in fact at first I made the boatman land me on the rocks, which I climbed, so as to be certain what it might be. This cactus is known as "durasnillas," and a little village near Hermosillo that we visited later is named from it Las Durasnillas. A few plants of a scarlet-flowered cereus grow on a sandy island, and afterwards it was seen in abundance in the interior.

Near the city and in many parts of Sonora, *Cereus Schottii*, which on the peninsula received not long ago the additional name *C. Sargentianus*, is common and assumes the various forms in which it grows on the peninsula of Lower California. The most distinct is the one in which the top bears spines similar to the lower part, and, although flower-bearing, large and old, entirely lacks those long white spines so characteristic of this species.

Notwithstanding the adverse conditions, some of the well known plants of the Guaymas flora were in full bloom. *Hofmeisteria crassifolia* blooms in the dry season, as does its near ally, *H. fasciculata*, of Cabo San Lucas, and was now crowned by its myriad of light-pink flowers, and like its Lower Californian relative delights to grow on cliffs just beyond the reach of the ocean spray. Now and then a small tree of *Guaiacum Coulteri* disdaining to follow the example of the other members of its species, covered its leafless branches with a mass of dark sky-blue flowers, and the brilliant effect of its erratic conduct was increased by the staidness of its surroundings, for it was a cloud of blue amongst a crowd of leafless grayish-brown bushes, resting on an ash-colored and baked adobe soil.

*Cæsalpinia*, *Hyptis*, *Jacquinia*, and other shrubs were evidently endeavoring to produce blossoms and fruit, but the drought was so excessive that only withered flowers were the result. That slender, drooping acacia, *A. Willardiana*, full of flowers and ripe pods, was found to be abundant on rocky ledges west of the city, and again later I was pleased to see it growing on a rocky hill almost within the city limits of Hermosillo.

The street railway of Guaymas ends in a semi-public park, in which grow two trees with willow-like leaves that would not be recognized as belonging to the fig family by anyone knowing only the cultivated figs of California. The owner says they were brought from below San Blas, and Dr. Palmer says that at least one of them grows also wild in the neighboring cañons. These two trees from which were collected the typical specimens of *Ficus fasciculata* and *F. Sonoræ*, are separated by a short distance; one bears numerous aerial rootlets and sends down to the earth roots from its branches; the other has neither of these peculiarities, but, as *F. Palmeri*, of Lower California, sometimes produces an abundance of aerial rootlets, and more often has none, their presence or absence cannot be considered a specific character. The two trees of Guaymas bear a general resemblance to one another; the leaves are alike, and at the time I thought they were one species, and afterwards was surprised to learn from Dr. Palmer that they represented types of two distinct species. Dr. Gustav Eisen, a well-known expert in fig culture, who has seen these same two trees, thinks it possible that they may represent the male and female forms of a single species, and says: "*F. fasciculata* possesses in the April crop of figs very few male flowers, about half a dozen to each fig, and these male flowers are situated in the region around the eye (osteolar region), and are not found dispersed among the female and gall flowers lower down."

Along the railway from Guaymas to Hermosillo and in the surrounding region, one of the most abundant plants is the thorny bush, or small tree, *Olneya Tesota*. At this time all its flowers were open, and they were so numerous that horses and cattle become fat eating them from the branches within reach, and from the ground where they have fallen.

The irrigated fields and gardens about Hermosillo were quite green when compared with the surrounding country, and much vegetation of interest was found, especially along the ditches and in the hedge rows. The dry rocks and hills of course did not produce many plants at this time of the year, but some collections of Perityle made among them, and by Dr. Eisen at San Miguel de Horcasitas, gave evidence that the awns of the pappus may be present or absent in the same species. *Hiræa macroptera*, a perennial plant, very common in the vicinity of Hermosillo, does not seem to suffer from the lack of moisture, for along the roads and in the very driest situations

its bright yellow flowers and winged seeds flourish amongst the surrounding dried-out vegetation.

The most interesting part of Sonora visited was Las Durasnillas, a small collection of houses about sixty miles from Hermosillo, near a mountain range known as Sierra Matapan. At this place was found a flora very different from any before seen, and some moist localities along the base of the mountain had retained their green and growing vegetation longer than was to have been expected. The most conspicuous plant was *Cæsalpinia pulcherrima*, with its large and handsome blossoms, compelling admiration from the least attentive. The very dark-purple flowered *Brongniartia Palmeri* was equally abundant. Some of the Pithecolobiums were in bloom, and under one of them our camp was made, as they furnished more shade than any other tree of the region, but a denser shade would have been more agreeable, because the hot sun found many openings among the scattered leaves and branches through which to send its rays. Among the trees and shrubs some are so different from familiar forms that they are a constant source of interest, and even the inhabitants recognized their peculiarities, and, after exciting our curiosity, guided us to the places where they grew. The cotton tree, *Eriodendron acuminatum*, is a singular tree, having the bark of its trunk thickly covered with large thorns, with leaves like those of the buckeye or horsechestnut, and large yellow flowers that are followed by bolls of cotton four or five inches long. When the fruit bursts and the tips of the twigs and branches of a spreading tree twenty feet high are adorned with good-sized bunches of cotton, the effect is very striking. Another tree, with a trunk sometimes two feet in diameter, that is always nearly white, and for that reason called "Palo blanco," surprises even botanists when they observe its botanical relationship, for it is an Ipomœa, a genus seen in more temperate climates only as low twining herbaceous plants. Among so many interesting plants, a few others are deserving of notice. Erythrina is represented by a single species here, and in Lower California by another very distinct one; both blossom in the spring, some time before the appearance of the leaves, and both retain their long pods after the short-lived foliage has fallen. The abundant large, dark maroon colored flowers are as beautiful in April as are the open pods that expose their scarlet beans in December. *Cordia Sonoræ* is completely covered with flowers that persist on the bushes and assume different shades of

color as they wither. In the cañons is *Vitex mollis*, a tree that is often planted in the gardens of Hermosillo, and many other plants interesting botanically, among which the following, which seem to have been undescribed, were found:—

ABUTILON (WISSADULA) CINCTUM. Perennial, 4–6 dm. high, stems slender, diffusely branching, white, with a thin appressed tomentum: leaves cordate-ovate, crenate-serrate, acute, on slender pedicels of about the same length, upper surface appressed pubescent, pubescence of the lower mixed with stellate hairs: flowers solitary on stout pedicels shorter than the petioles, not jointed: bracts linear-oblong, caducous: calyx cuneate at base, 10-angulate, cleft less than half its length into five lanceolate acute lobes, covered with long spreading hairs, which also occur sparingly on petioles, peduncles, and on the margins and veins of the leaves: corolla ½–2 dm. broad, light-purple or lilac, segments cuneate-obovate, inequilateral, twice the length of calyx, tomentose in the angles, erose at summit: stamineal column very short, horizontal: stamens ⅔ the length of the petals; anthers by the unusual development of the double septum, spuriously two-celled, developing a large quantity of mucus when wetted: ovary 3-celled; ovules three in each cell, the two upper collateral; styles three, capitate, united only at base, minutely and sparsely stellate hairy; carpels three, rounded at apex, loculicidally-dehiscent to the base within, two-thirds the length without, constricted below the middle by a callous ring which is higher anteriorly and posteriorly than at the sides; upper seeds smooth, lower conformed in shape to the cavity, tuberculate punctate at the sides, and crowned by a hirsute ring; radicle superior.

This plant hardly belongs to the genus Wissadula, yet according to Grisebach's Flora of the West Indies, it would be included in the Wissadula section of Abutilon. The constriction between the upper and lower cells is not very apparent externally and does not amount to occlusion of the lower, but insomuch as it approaches Abutilon weakens Wissadula. The shortening of the stamineal column the tricarpellary ovary and collateral ovules occur in other species of Abutilon. It was collected near Las Durasnillas, Sonora, Mexico.

ANISACANTHUS ABDITUS. Perennial, the few stems virgate, indurated herbaceous, bearing short branches, leaves and flowers above, the whole plant minutely puberulent and abounding in stipitate

glands: leaves ovate-lanceolate, 2–3 cm. in length on slender petioles more than half as long, the uppermost reduced to sessile bracts: proper bracts lighter green than the leaves, ovate-lanceolate, a pair sessile in each of the upper axils, 8–12 mm. long, nearly twice the length of the concealed calyx: flowers sessile, one or two in each pair of bracts: calyx cleft to the base, lobes lanceolate-acuminate: corolla rose-color 3–4 cm. long, the rather slender tube somewhat curved and a little longer than the nearly equally cleft and spreading lobes: anther cells muticous, parallel, one very slightly lengthened below: capsule oblong, 2 cm. long, the stipe-like portion occupying half the length; seeds flattened but thick, apparently violet in color, covered with short, sinuous ridges.

This plant was found growing about a spring on the Sierra Matapan. Its habit and flowers resemble those of related species, but its large bracts, of a lighter color than the leaves, make this a very distinct one, and the numerous blossoms crowded at the upper part of the stems surpass in beauty those of the well-known members of the genus Anisacanthus.

## MAMILLARIA NOTESTEINII BRITTON.

Since the sending of my first specimen to Dr. Britton I have found quite a plantation of them, and after examining a number have thought it best to modify the original description.

MAMILLARIA NOTESTEINII Britton, stems ovate, simple, or occasionally cæspitose, 2–8 cm. in diameter. Tubercles nearly terete and about 2 cm. long, spines 12—18 white, becoming gray with age, weak and slender, 1—2 cm. long, spreading. The central spine, which is longer and stronger than the others, is generally tipped with reddish-pink. Pubescent throughout. Flowers 2—4 cm. in diameter, ash-gray, tinged and penciled with a delicate pink. Petals linear oblong, mucronate tipped; sepals fringed; fruit scarlet, obovate; seed black, globose, pitted. Soil and exposure to sunshine changed the amount of coloring and penciling.

Found by the writer in gravelly soil, near a small creek, in this vicinity, June 4, 1891. F. N. NOTESTEIN.

*College of Montana, Deer Lodge, Mont.*

# NOTES ON THE ANIMALS OF SOME WEST COAST SHELLS.

BY HENRY HEMPHILL.

*Trivia solandri* Gray. A single living specimen of this beautiful little mollusk recently collected by Miss Ida M. Shepard, at Ballast Point, San Diego Bay, and which she kindly brought to me for examination, enabled me to make the following note on the animal.

When the animal is fully extended, the mantle lobes completely envelop the shell. The lobes are of a brownish flesh-color, thickly though not closely crowded with mammillated tubercles, about thirty-five on each side, flecked and frosted with whitish specks. The tubercles vary some in size and form, the larger ones being rounded and broad at the base, while the smaller ones are narrower and more conical. The nipple-like processes that rise from their summits vary in number from one to four on each tubercle, their tips being also frosted with whitish specks. The spaces between the tubercles are a shade darker than other portions of the mantle, and peppered over with irregular black specks. The edges of the mantle lobes that meet on the summit of the shell are lighter in color than other portions of the mantle, and are also covered with black specks like those between the tubercles.

When the animal is in motion the proboscis extends forward like the bowsprit of a boat; it is about ½ an inch long, a shade or two lighter than the mantles, flecked with whitish specks like those on the tubercles, with its end slightly expanded and edged with white. Two slender tentacles about $\frac{5}{16}$ of an inch long when fully extended protrude from the head near the base of the proboscis, each one bearing a black piercing eye, about midway between their tips and the head of the animal.

The foot is about as broad as the shell, truncated in front and roundly pointed behind, when the animal is in motion. The front of the foot is marked beneath by a very fine transverse dark line, which perhaps serves to define the front edge of the sole. The sole is lighter colored than other portions of the animal that are exposed outside of the shell, and is beautifully and profusely flecked with very small whitish dots.

The animal was slow in its movements, its motion being a contin-

uous glide around the vessel in which it was confined, but most of the time it remained stationary at the edge of the water, as if waiting for the tide to come in, or a chance to escape.

*Conus californicus* Hinds. The body of this mollusk is whitish in color, and profusely dotted over with black specks that frequently coalesce near the margin of the mantle. When the animal is in motion the foot extends about ¼ of an inch beyond the anterior and posterior ends of the shell. It is truncated in front and bluntly pointed behind. The sole is white and sparsely sprinkled with black specks. The motion of the animal is a constant glide. The proboscis is black, and about ½ an inch long when fully extended, and seems to be a specialized portion of the animal's mantle, rolled together with the lower edges in contact but not joined. It curves over and above the back of the shell, as the animal moves forward. Two small tentacles, of a dark color, each 5 millimeters long, protrude from the head near the base of the proboscis, bearing two small keen eyes, which are situated about half way between the tips and base of the tentacles.

The operculum is horn-color and claw shaped, a portion of the lower or sharp end being free from the animal.

When the animal is in motion this operculum lies transversely across the upper side of the posterior part of the animal's foot.

The nucleus of the young shell is white and glassy, and after a few turns the spire resembles a bluntly pointed, round peg. After this the upper end of the whorls rapidly enlarges, as also does the length of the whorls from the anterior end of the shell to the shoulder.

In the adult the body of the shell is covered with numerous revolving lines, more prominent near the anterior end of the shell.

On the spire of some specimens there are also strong revolving lines, while on others these lines are entirely obsolete. The shoulder of the last whorl is rather concave and forms a shallow subcanal around the shell at the base of the spine, but this, like all other characters of shells, is very variable, and in some individuals it is absent.

The whole shell is covered with a dirty yellowish epidermis that frequently darkens into chestnut color. The shells are quite brittle and very frequently broken, which perhaps is due to the thin, sharp

outer lip, and an excessive amount of carbonate of lime in their composition. The bungling manner in which the animal repairs these fractures does not add to the beauty or attractiveness of the shell, which even in its perfect state is not very inspiring, especially when we consider the beauty of many other cones.

*Terebra simplex* Cpr. The animal that inhabits this shell is of a pure, pearly white color, without spot or blemish. When fully extended, its foot is about ⅓ the length of the shell. The proboscis is slender, about as long as the foot of the animal, gracefully curved over the back of the shell, and when the animal is in motion it forms an interesting and conspicuous part of the creature, and seems out of all proportions in its length to the rest of the animal's body. This animal has no tentacles, but the eyes are situated on mammillated tubercles that protrude from the body midway between the foot and proboscis. The eyes are small, dark and keen; the foot is truncated in front and rounded behind. The operculum is carneous, unguiculated in form, and lies on the upper side of the posterior part of the foot. This shell is abundant at San Diego and southward.

## NOTES ON CALIFORNIAN PLANTS. IV.

BY S. B. PARISH.

### VARIATIONS OF CALOCHORTUS VENUSTUS BENTH.

This species, not uncommon in the central region of the State, extends as far south as Elizabeth Lake, in Los Angeles County. Here at its southern limit it is strictly typical; the stem stout and branching and from 18 to 24 inches high; the flowers light lilac, the petals marked above with a reddish stain, below that a brown, yellow-edged occulation, and the basal portion brown-striate; the densely hirsute gland narrowly oblong, and surrounded by scattered hairs. The plants are not very abundant here, but among a considerable number observed not one manifested any noticeable variation.

Hardly fifty miles further north, at Fort Tejon, on the borders of Kern County, they are very plentiful, but here, on the contrary, they show a range of color variation which I have seen in no other plant that has not been subjected to the art of the hybridizer. Specimens growing on the flats about Lake Castac were sufficient to unmistak-

ably fix the species; indeed, they differed only in having the markings less distinct and well defined. But on the precipitous sides of the surrounding grass-clad mountains, where every recess or gentler acclivity was a thickly set bed of these flowers, all the color character of the species vanished. Repeatedly I found it easy to gather from one of these parterres a dozen flowers, each abundantly distinct for a florist's variety, and some of which, if considered by themselves, a botanist might well regard as distinct species. But with all the intermediate variations so profusely present the most diverse extremes were traceable to the original form.

A little study resolved these many-hued varieties into two series, the one of lilacs and the other of yellows. In the former the range of color proceeded from white through varying shades of lilac to a deep purple, the extreme being the var. *purpurascens* Watson. The other series passed through similar gradations from very light yellow to a bright lemon color, which may be identified with the var. *citrinus* Baker.* Sometimes the petals were of uniform color throughout, or were shaded from light to darker tints; in others a lilac petal passed into a yellow border above, or the reverse; others again were yellow striate with lilac, or lilac with yellow. The upper and lower spots of the normal flower were occasionally indicated in these varieties, but in most instances were entirely obsolete.

The glands were uniformly densely hairy, but varied much in size and shape, being oblong, oval, or transversely flattened. In some instances they were obsolescent. All the plants were slenderer stemmed and fewer flowered than in the normal form, single flowered specimens being common, and few exceeded a foot in height. The flowers varied much in size, but were generally smaller than in the type. The whole exhibition appeared to be an example of pure natural variation uninfluenced by hybridization, since no other species was observed in the neighborhood.

Considering how completely all distinctions of color and markings, or of size and shape of gland, here break down, it becomes a question as to what value can be placed on these characters in a group of closely allied species which inhabit the same geographical region.

*In Dr. Watson's Revision of the N. A. Liliaceæ, and in the Bot. of California this is referred as a variety to *C. luteus*, Dougl., the most natural disposition to make from herbarium specimens. But, considering the associations with which it grows on these hillsides it is evident that Baker was right, if the two species are to be kept up.

It is precisely on such treacherous grounds that *C. luteus* Dougl., *C. venustus* Benth, and *C. splendens* Dougl. were established, and more recently *C. Lyoni* Gray and *C. Plummeræ* Greene have been added to the number. Dr. Watson has already suggested that the first two may be confluent, yet in their typical forms they are the most distinct of the set, the first being yellow and the second lilac purple in color. Yet field observation compels the reference of a yellow variety to the lilac-colored species. The other species above named all belong to the lilac series, differing from each other in the distribution and intensity of the coloration. In this respect typical specimens are sufficiently distinct, but considering the unreliability of this character it is not impossible that further observation may unite them.

LILÆA SUBULATA HBK. A rare plant in the South, and apparently the same elsewhere in the State. The only station known to me is the marshy margin of a shallow pond on the farm of Mr. James Stewart, near Colton. Fresh plants show some characters not in entire accordance with the published diagnosis of the species, which was perhaps drawn from dried specimens. Our plant is an annual, the leaves terete, or a little flattened, about six inches long, sheathing at base. Inflorescence axillary, of two forms; an androgynous spike exserted on a peduncle shorter than the leaves, and arising between two sessile ovaries whose filiform styles nearly equal the peduncle. I find no spikes entirely male. The anthers discharge their pollen while the spike is still inclosed in the sheathing bases of the leaves. The radicle fruits mature long before the spicate ones.

## GENERAL NOTES OF A TRIP THROUGH SOUTHEASTERN UTAH.

BY ALICE EASTWOOD.

It was my good fortune the past year, towards the end of May, to travel on horseback through a part of the Great American Desert that has been but little explored. The road followed was a cattle highway from Thompson's Springs, a station on the D. & R. G. W. R. R. in Utah, to Moab, a Mormon town on the Grand River; thence to Monticello, another Mormon settlement at the foot of the Blue Mountains; thence down Montezuma Cañon to the San Juan River,

not far from Bluff City, where the gold placer excitement has recently existed; from there, by way of McElmo Creek and Montezuma Valley, to Mancos, a town in southwestern Colorado.

Mr. Alfred Wetherill, who was my guide, planned the route, managed everything about the camp and horses, helped me greatly in collecting, and, altogether, was as good a friend and as efficient an aid as any botanist could desire.

Thompson's Springs is so named because of its relative nearness to water. In a desert country the watering places become the centers, the named places on the map, and though they may be many miles away from a railroad station, yet more than the small cluster of buildings serve to locate to the cattle men, who are almost the only travelers, the general situation of any place. The name would suggest moisture and verdure, but besides the water tank and a feeble stream of yellow alkali water at the bottom of a gulch, everything was dry. However, it was the period when vegetation was most luxuriant, and the earth was gay with flowers. *Townsendia strigosa* almost carpeting the ground in spots, recalled Burns' "wee crimson-tipped flower;" *Thelypodium ambiguum*, with its branching habit, glaucous foliage, and numerous clusters of rose-pink blossoms, gave brightness here and there; while within the precincts of the station were *Aster tanacetifolius*, *Arabis longirostris*, *Abronia micrantha*, *cycloptera* and *turbinata;* a Conanthus differing most noticeably from *Conanthus aretioides* in its smaller flowers, *Œnothera scapoidea* and *trichocalyx*, *Atriplex corrugata* and *Nuttallii*, and the shrubs so frequent in the desert, such as *Grayia polygaloides*, *Artemisia tridentata* and *spinosa*, *Bigelovia graveolens* and *Tetradymia spinosa*. So many of the desert shrubs are spinose, because nature is here such a niggardly provider that their ambitious efforts to become big plants are thwarted, and they must remain straggling, woody, spiny shrubs.

There was no time for exploring the country around Thompson's Springs, nor for branching off onto the alluring mesas and into the side cañons along the road. An early start had to be made so as to reach a spring at noon and Moab at night, allowing plenty of time for collecting on the way.

Some time after we left the station there stretched before us a range of low hills, where the evidences of upheaval were unusually

conspicuous. On each side of a slight depression, which was a rise compared with our starting place, the bands of strata were tipped up slanting towards each other, and plainly matching. It was from this break in the strata that the cañon began, which at first imperceptibly, but later more decidedly, became deeper and deeper, until when we reached the Grand River, the rocky walls seemed to rise perpendicular for a thousand feet at least, and here and there were carved into wonderful and weird outlines by the action of the air and water. The vegetation constantly changed, for we were not only descending, but also passing from the flora of the plain to that of the cañon.

It was a day full of delight; new plants were constantly seen, and some that may be new species were collected. *Lupinus pusillus* was so abundant over large areas that the earth seemed to mirror the sky, while occasionally the rarer *Lupinus Shockleyi* was also seen; *Cleomella plocasperma*, or a nearly allied form, was found growing in a small tract with a most peculiar and new Phacelia. *Eriogonum inflatum* was common over miles of country, and it was noticeable that the amount of swelling at the nodes varied from absolutely none to more than an inch in diameter. The plants destitute of inflation were small and weak, compared with the others, and the question arose as to the cause of the difference. The evolutionist would regard the variation as an illustration and living proof of the formation of a new species, and would look upon the plants without inflation as the original from which the inflated forms arose. The inflation is a feature especially beneficial to a desert, slender-stemmed annual and undoubtedly takes the place of the involucral bracts that most Eriogonums possess. It furnishes the surface essential to the vital functions of the plant during the ripening of the fruit, since the leaves at the root, by which the plant was enabled to raise its stem and spread out its branches, become dried into dust long before the flowers are gone, and often before they are in bloom. It can easily be seen what an advantage the inflated plants have over the others in the struggle for existence, and they show their superiority in greater size and abundance. They even crowd out other plants and almost usurp the soil. New Astragali were continually seen, and were collected in both flower and fruit. *Gilia Gunnisoni*, *Biscutella Wislizeni*, *Coloptera Newberryi* and *Asclepias involucrata* grew on a

sandy bottom, and the Gilia was most abundant and very lovely. In washes, *Encelia nutans* was frequent. Its large head is full of good sense as well as many flowers. When the flowers expand, the head is erect, so that the sun can have its full effect; but when the seeds are nearly ripe, it begins to nod and droops lower and lower until it finally touches the ground and the seeds scramble out so that they may travel far away from their big-rooted mother on the first rush of water that comes down the hills from the heavy rains that sometimes fall. They thus secure a congenial home in a branch wash and do not have to starve on their greedy mother's leavings.

Through the cañon, which we entered in the afternoon, new and attractive plants began to appear. Here and there *Penstemon Eatoni* lifted its showy stems, covered with scarlet drooping trumpets, demanding admiration. *Malvastrum leptophyllum*, with slender, wand-like blossoming stems, was a fine study in harmony of color, the brick red of its flowers toned down by the silvery green of the foliage. *Aster venustus* here has smaller flowers than at Grand Junction, and with violet rays instead of white. *Amelanchier alnifolia* exhibited a new form, more slender and less leafy than the common one, with few flowers, and the leaves glossy on the upper surface. Some plants of *Rhus aromatica* were seen, with entire coarsely crenate leaves. *Fraxinus anomala* and *Quercus Emoryi*(?) sometimes formed thickets. Piñons and cedars grew along the hills, and bunches of rosaceous shrubs, such as Purshia and Cowania were occasionally observed. Cacti were rare, and but one, an Opuntia, with long, slender white spines, probably a form of *O. Missouriensis* was collected or even noted.

Near the Grand River, the space between the cañon walls became wider. It was a sandy bottom, and the wind blew the sharp little bits of quartz and feldspar into our faces in a disagreeable manner. Twilight was impending, but there was still sufficient light to indicate that a flora more peculiar than any seen yet, existed here. In spite of the raging river that must be crossed we resolved to return to this spot in daylight and explore more fully. *Mentzelia multiflora* was the plant most conspicuous in the waning light, and the star-like blossoms opening at our feet seemed to be trying to illumine the way.

The next day's search was cut short by one of those rainstorms

that are called cloud-bursts, where the water descends in sheets and in a short time starts waterfalls that leap a hundred feet in places over precipices, to the slope below, and then rush to the river. Before the storm, however, we secured a Hoffmanseggia that seems to be new, a peculiar form of *Linum rigidum*, *Eriogonum Thomasii*, *Coldenia hispidissima*, *Poliomintha incana*, *Glyptopleura marginata*, *Euphorbia flagellaris*, *Encelia frutescens*, and fine fruiting specimens of *Coloptera Newberryi*. This had before been collected in flower; but it was only now that its puzzling character began to appear. No two seeds were to be seen that looked alike. It was trying to be a Cymopterus and a Leptotænia at the same time, and even its leaves showed the struggles which it was experiencing. Along the river banks were willows, and the common *Baccharis salicina*. *Berberis Fremonti* grew at the foot of the cañon among the rocks, under which we were perfectly sheltered from the storm. *Stephanomeria exigua*, beautiful with its numerous spreading pink blossoms in the early morning, was a bedraggled object after the rain; *Erigeron Utahensis*, just coming into bloom, seemed to be rare; *Brickellia linifolia* in flower along the slopes, and the young shoots of *B. microphylla*, which is a fall-bloomer, were also observed; *Aplopappus Nuttallii*, *Phacelia crenulata* and *Amsonia brevifolia* were there at home too.

Moab is an oasis in a desert, and its poplars might be compared to the palms that made Palmyra so famous for beauty long ago. It is as renowned, too, among the pilgrims through this land, and we had heard of its beauty, its fruits, and its hospitable people before we started. Its green fields, lovely orchards, and extensive vineyards were such a sudden change from the dry country around that, undoubtedly, the impression of its loveliness was made more vivid from the surroundings.

The next day was spent on a barren highway, where whatever green thing could survive the drought fell a prey to the cattle that were driven over that road. The ground was tramped down and marked with the impressions of innumerable hoofs. Towards evening we entered one of the basin-like cañons, called "washes," peculiar to that region. Here was found a Gilia worth thirty-five miles through the dust and heat. It is one of the most beautiful of the genus, and well deserves the name *superba*, which has been bestowed upon it.

The following day was more profitable in the number of plants collected, but as quantity does not always make up for quality, it is doubtful whether it was really more successful. Here and there on the hillsides *Yucca augustifolia* was sending up its flower-stalks; on the mesas which we crossed, a Frasera, taller and more loosely flowered than *F. albomarginata*, was getting ready to bloom; *Berberis Fremonti* became more common along water courses, and was beautiful with the showy yellow flowers amid its holly-like leaves; *Psoralea castorea* spread over sandy slopes. In a small cañon we found the greatest variety seen in one place, and collected *Allium Nevadense?* *Penstemon Parryi*, *Ephedra trifurca* in fruit, a small flowered variety of *Gilia congesta*, an Arabis which is probably a beautiful, rose-colored, large-flowered form of *A. Holbœllii*, found also at Grand Junction, and the widely-distributed *Krynitzkia leucophœa*, the only one of the spicate and glomerate Krynitzkias that can be determined with certainty, because of its smooth, shining nutlets. This cañon led up to a mesa covered with piñons and cedars, and again we were in a region of few flowers, *Penstemon Parryi*, *Gilia congesta*, *and Krynitzkia leucophœa* being almost the only plants under the low trees. We crossed another piñon-covered mesa, after leaving Monticello, and in that little-visited locality found a few plants of *Erodium cicutarim*, the offspring of some daring pioneer. It was a great surprise, and the place at once lost some of its wildness. *Trifolium Plummeræ* seemed common, but was past its period of bloom, and almost of fruit as well.

We were aiming to cut across country, because a cattle highway was so barren, and after great difficulty succeeded in reaching the bottom of Montezuma Cañon, intending to climb up the other side and then ride across an unbroken mesa to McElmo Creek. Montezuma Cañon proved to be a prison from which we could not escape until we reached the San Juan River. Its walls were perpendicular for miles, and impossible to climb with horses. Whenever a hill could be ascended, we toiled up and led our poor animals, only to behold a labyrinth of cañons beyond. However, as we continued to find new plants and were exploring country perhaps as pioneers, we somewhat forgot that our stomachs were empty and our provisions low. *Frasera albomarginata*, *Cymopterus purpureus*, *Calochortus flexuosus*, *Polygala acanthoclada*, *Eriogonum salsuginosus*,

*divaricatus*, and *glandulosus*, several Astragali, *Gilia pungens*, *Lygodesmia exigua* and *Cnicus Neo-Mexicanus* were among the plants noticed on the rocky hills and cedar-covered mesas. Along the river bottom the grass was high and the trees near the water formed a low grove of box elders, willows and cottonwoods. *Calochortus Nuttallii* was in bloom, and quite common. In general the plants were the same as those usually found not far from water, and as we approached the San Juan River the trees were replaced by *Sarcobatus vermiculatus*, *Bigelovia graveolens*, and *Artemisia tridentata*, so tall as to hide us completely from each other. They all make fine camp fires, but Sarcobatus is the best. We thought that we might also have to try them for internal combustion, but an Indian store on the San Juan River saved us from the attempt.

Along the San Juan River the vegetation was not different from the lowlands of Montezuma Creek; some chenopodiaceous plants were seen, but too young for determination, though as *Grayia Brandegei* was known to grow in that vicinity, all were closely examined and found to be young Atriplices, probably *argentea* and *Nuttallii*. Thickets of *Forestiera Neo-Mexicana* were here and there, and *Lycium pallidum* occasionally replaced the usual desert shrubs. The looked-for Grayia was not found until the McElmo Creek was reached, where many other interesting plants now appeared. *Datura meteloides* was rather startling. It is not supposed to grow so far north, but here it was abundant in the dry bed of the creek and occasionally along the sides. The seed pods are often found in the ruins of the ancient people who once filled this land and guarded every spring with towers of stone. The hackberry, *Celtis occidentalis*, was a new and uncommon shrub; but the other shrubs were those found throughout the whole region. *Œnothera Hartwegi* var. *lavandulæfolia*, was noticeable occasionally, and a few more new Astragali were found, as well as some other plants previously collected, such as Biscutella and *Calochortus flexuosus*. In Montezuma Valley the shrubs were in full bloom, and the hillsides were beautiful with *Peraphyllum ramosissimum*, *Fendlera rupicola* and *Amelanchier alnifolia*. A single plant of the Grand Junction *Chænactis scaposa* was collected, which extends its range two or three hundred miles, the extent of country through which we had ridden during our ten days' trip.

The region traversed belongs mainly to what Dr. C. Hart Merriam

has designated as Upper Sonoran. No mountain species were seen, and but few of those common everywhere along water courses. Animal life was scarce; rarely was even a rabbit noticed or the song of a bird heard.

The careful studies of the plants collected and the list of those noted and collected will form the subject of a paper to which this is an introduction.

## GENERAL BIRD NOTES.

EDITED BY WALTER E. BRYANT.

### A TRAGEDY IN BIRD LIFE.

One stormy day in December found me on Damon's Point, at the north entrance of Gray's Harbor. A great gale was blowing and the rain and spray were driving in from the sea in clouds. Gun in hand, I strolled toward the beach to view the surf, which was running very high.

A broad, sandy bay made in from the harbor, the upper end of which terminated in a shallow slough about eighteen inches deep. I waded across and was proceeding toward the beach, when my attention was attracted by a small buffle-head duck (*Charitonetta albeola*) commonly called butter-ball. He was swimming around in the slough and obtaining his food in the way common to his kind, by diving and picking up that which came his way. With an admiring glance at his beautiful plumage I was about to pass on, when one of those pirates of the air, a duck hawk (*Falco peregrinus anatum*) came in sight.

Without hesitating an instant, he made straight for my little friend and swooped at him. His long talons came down with a clutch, but they closed on nothing, for the duck was under the water. Undaunted the hawk hovered overhead, and as the water was clear and shallow, he could follow every movement of his prey. Again the duck came up; the hawk swooped to seize him, each move being repeated in quick succession and each dive becoming shorter and shorter.

It was evident that the poor little hunted creature was getting desperate, for the next move he made was to come out of the water flying. The hawk promptly gave chase. There was some clever

dodging in the air, but the duck, frightened and tired, soon saw that his swift pursuer was getting the best of it, so he closed his wings tight against his body and dropped like a stone into the water and plunged out of sight.

Now comes the beginning of the end. While he was under water he either saw the hawk hovering over him or else he became bewildered, for he came again out of the water flying. Like lightning the hawk struck; there was a muffled "squawk," and the tragedy was ended. SAM. HUBBARD, JR.

### PUGNACIOUS FLICKERS.

The following facts were related to me by my brother. And there is a fine skin of one of the birds in my collection.

One day he heard a commotion in the loft of the barn, and, thinking that perhaps the cat had caught a bird, he ascended to discover the cause. In the eaves of the barn was a hole made by woodpeckers. Fighting vigorously through this hole were a couple of flickers (*Colaptes cafer*). The birds made such a din that they did not notice his approach and he easily took the inside one in his hand. The bird on the outside, probably thinking that it had vanquished its enemy, promptly entered in pursuit and was in its turn taken in the other hand.

How blind must have been their rage, and how perfectly oblivious of their own end they must have been, for, although still in the hands of their captor, upon being brought together, they would immediately resume the combat, fighting with bill and claws as though their fate depended upon the result.

It would have been interesting to have discovered the cause of the dispute. Perhaps the explanation may be found in the fact that both the contestants were females, and it may have been the outcome of a fit of jealousy. EDWARD C. MERWIN.

### THE MOCKING BIRD AT REDWOOD CITY, CALIFORNIA.

In regard to the occurrence of the mocking bird (*Mimus polyglottos*) in this vicinity, I would say that the specimen which I now have in my collection was taken here in Redwood City, September 5, 1891. It was hopping about the ground in search of food, and, although exceedingly watchful, could not be called shy, as it ap-

proached within forty feet of me before I saw it. They are rarely seen here; I have met with but three others during the past twenty-five years. Two of them were shot years ago before I knew anything about preserving the skins; the other was seen in 1880 near my home, but was too wary to be collected. They seem to prefer the company of blue jays (*Aphelocoma californica*), as the last three specimens were with large scattering flocks of these birds and apparently flying about the country with them in search of food.

CHASE LITTLEJOHN.

### SECOND OCCURRENCE OF THE FOX SPARROW IN CALIFORNIA.

In San Diego County, January 3, 1888, Mr. C. M. Ingersoll collected a specimen of the fox sparrow in no respects different from Eastern examples. (See Proc. Cal. Acad. Sci. Ser. 2, ii, 9c.) Another specimen has been obtained in Oakland, by Mr. W. H. Hall, who writes: "The bird was brought to me December 2, 1892, having been found in the city directly under a telegraph wire, and was still warm."

W. E. BRYANT.

### NESTING OF THE FLORIDA GALLINULE (*Galinula galeata*) NEAR LOS ANGELES, CAL.

I now have a set of nine eggs of this bird; they were collected west of the city, just outside of the city limits, by William Berman, April 27, 1890. Nest was composed of tule, situated in a bunch of tule in a creek. One or two other sets were obtained at the same time and place. A bird was shot and identified by L. Zellner, of this city.

M. L. WICKS, JR.

### OCCURRENCE OF CLANGULA HYEMALIS IN CALIFORNIA.

Mr. W. H. Hall has brought to me for identification a female specimen of the old-squaw (*C. hyemalis*), which was shot at Point Reyes, north of San Francisco, about January 17, 1893, by Mr H. Weiss. In the Proceedings of the California Academy of Sciences (2d. Ser., ii, p. 88) Mr. T. S. Palmer recorded a male specimen from Humboldt Bay. While of rare occurrence in this State, it may be considered a casual winter visitant.

W. E. BRYANT.

## RECENT LITERATURE.

*The Occurrence of Cooper's Lemming Mouse* (*Synaptomys cooperi*) *in the Atlantic States*. By DR. C. HART MERRIAM. Proc. Biol. Soc. Wash. VII, 175–177. Notices of the capture of additional specimens of this species, rare in collections, Baird's type of which the author supposes came from New York State, possibly from New Jersey.

*The American Naturalist*, January, 1893: "A new Synaptomys from New Jersey," by Samuel N. Rhodes. This new species is named *Synaptomys stonei*. "A new Evotomys from Southern New Jersey," by Witmer Stone. This new subspecies is named *Evotomys gapperi rhoadsii*.

The January number of *The Auk* has two half-tone plates, illustrating an article by Charles Slover Allen, on "The Nesting of the Black Duck on Plum Island." One represents a nest in a thicket, the other a group of black ducks, two adult birds with young, from the representation so successfully executed by Mr. Richardson for the American Museum. "Notes on Certain Washington and British Columbia Birds," by Samuel N. Rhoads. A preliminary paper with a list of additions and critical notes on the status of *Corvus americanus*, *C. caurinus*, *Melospiza lincolni striata*, which is considered "less entitled to recognition than certain subspecies once included, but now stricken from the check list." One of these "stricken" forms is *Vireo gilvus swainsonii*, for which evidence is offered for its re-instatement. *Sylvania pusilla pileolata* is considered a very weak subspecies. One new subspecies is described from the central Rocky Mountains of British Columbia, *Parus hudsonicus columbianus*, Columbian Chickadee, of which the A. O. U. committee will take cognizance. "Description of a New Junco from California," by Leverett M. Loomis, *Junco pinosus*, Point Pinos Junco, from near Monterey. The fifth supplement to the check-list of North American birds, which appears in this number, contains important additions and changes. The sparrow hawk of California becomes *Falco sparverius deserticolus* Mearns, Desert Sparrow Hawk. *Vireo vicinior californicus* Stephens was "considered as not entitled to recognition." Mr. T. S. Palmer proposes *Heleodytes* Cabanis for *Campylor hynchus* Spix antedated by *Campylirhynchus* Mergèle, a genus of coleoptera.

Gordiodrilus is the name of a new genus of Oligochæta provisionally placed in the family of Ocnerodrilidæ by its describer, F. E. Beddard (Ann. and Mag. Nat. Hist., ser. 6, Vol. x, No. 55). The genus comes near the American genus Ocnerodrilus, which later reaches its greatest development, as far as is known, on the Pacific Coast. Gordiodrilus differs from Ocnerodrilus in having only one œsophageal diverticulum in somite ix, Ocnerodrilus having this organ paired. The male or spermduct, which in Ocnerodrilus opens in somite xvii, always in the same pore as a prostate, opens in Gordiodrilus in somite xviii, always in a different pore from the prostate, but in the same somite as that organ. Beddard describes five species of Gordiodrilus from Africa and the West Indies. The memoir is very interesting to Pacific Coast investigators, as the new genus forms a connecting link between Ocnerodrilus and the higher terrestrial Oligochæta. Here may be incidentally mentioned that a new genus not yet described, recently found in Baja California, is in many respects intermediate between Ocnerodrilus and Gordiodrilus, having one pair of diverticula in somite ix, originating in the anterior part of the somite. The spermduct opens in somites xviii and xvii, the posterior one independently of the prostates, one pair of which open in somite xvii and one in xix. G. E.

"Expedition a la gruta de Cacahuamilpa." Under this heading we find a memoir of twenty pages, describing the results of a collecting expedition to a cave called "Cacahuamilpa," somewhere in Mexico; the exact locality is not given ("El Estudio," Tom IV, No. 8, Mexico, Sept., 1892).

The memoir is accompanied by two plates containing forty-five drawings of animals, described as new in a most singular manner. There are eleven species pretended to be new, ranging in almost as many different families, from Coleoptera to mollusks and mammals, and all are given as specific name "cacahuamilpensis." Many species are given a new name, probably in order that all may be uniformly "cacahuamilpensis," though the old and first name is sometimes kindly appended. The descriptions are such that not a single species can be identified, not even as to genus, and the figures are in the style of those seen in our daily newspapers.

It would have been much better to distribute the collections to specialists than to disgrace the zoölogical literature in this way.

Unhappily we are promised a continuation, which, if in a similar style as the first part, will no doubt cause the author to become a great light among the natives, but which must nevertheless be considered at a par with similar attempts one hundred and fifty years ago. How many of these "cacahuamilpensis" are really cave-species probably no one will ever be able to tell. G. E.

Description of a new sucker (*Pantosteus jordani*), from the Upper Missouri Basin. By Barton W. Evermann. Extract from Bull, U. S. Fish Commission for 1892. The name is in compliment to Prof. Jordan of Stanford University. The material was collected in the streams of Montana and South Dakota. The author recognizes four species besides the new one, and gives their synonomy and distribution.

*Flora Peoriana*, by FREDERICK BRENDEL. This paper catalogues the plants within a radius of ten or twelve miles. The vascular plants number 835 species. The paper is replete with interesting data not usually found in such catalogues. K. B.

*Development of the Frond of Champia parvula*, Harv. *from the Carpospore*, with one double plate. By BRADLEY MOORE DAVIS. Extract from Annals of Botany, No. xxiv. This interesting addition to our knowledge of *Champia parvula* is one of the first fruits of the Stanford University course in botany. Mr. Davis was in charge of the summer course of botany at the Hopkins Seaside Laboratory last year, and is now following a postgraduate botanical course at Harvard University. We hope to welcome him again to the Pacific Coast next year. K. B.

*Additions to the Flora of the Cape Region of Baja California* (Ext. from Proc. Cal. Acad. sec. 2, Vol. iii), by T. S. BRANDEGEE. In this paper Mr. Brandegee adds 59 species, Nos. 681–739, to the known flora of the region. Notes of interest concerning some previously listed species are given and the following new species proposed: *Dalea trochilina*, *Acacia Californica*, *Albizzia occidentalis*, *Dianthera incerta*. K. B.

*Erythæa*, a journal of botany, West American and general, edited by Willis L. Jepson, a pupil of Prof. Edward L. Greene. The new journal is to be a monthly of about twenty-five pages apparently.

The contributors to the first number are Prof. E. L. Greene, two papers; Willis L. Jepson, two papers; F. T. Bioletti, descriptions of two new plants. Teratological notes (reversion of the flowers of *Leptosyne maritima* and *Tropæolum minus*) by Marshall A. Howe. Reviews and criticisms, miscellaneous notes and news. The inside of the cover is apparently modeled after some of Rafinesque's publications, containing an advertisement of the journal within the first cover, and a list of the "principal botanical writings" of Professor Greene inside the back

The motto of the journal might fitly be the following paragraph from the introduction to Rafinesque's "Neobotanon," Part 4: "As I think that I am gifted with a peculiar sharp sagacity in discriminating Genera and Species of Plants and Animals, it behooves me to use it in order to rectify these objects and the sciences relating thereto.—It is what I have often done, am now doing and will continue to do as long as I live, not being prevented by the sneer or neglect of anyone whom I consider less sagacious than myself, who cannot discriminate between the most conspicuous characters blended by the Linneists or modern Blenders and Shufflers."

Mr. Greene starts out by alluding to his "reasons for accepting the Cichoriaceæ as a separate natural order, forgetting, perhaps, his experience in describing "*Prenanthes stricta*," and makes declaration that "for the nomenclature of genera we are not disposed to recognize any particular initial date." The usual contributions to the synonymy of Western botany to be expected in a publication over which Mr. Greene has control, follow. *Pulsatilla multiceps* may be, from its very imperfect description, almost anything. *P. Micheneri*, appears from the character to be a rather more glabrous form of *P. Bolanderi*, that species having cuneate-obcordate petals and 10 dilated filaments, the alternate ones shorter.

Mr. Greene has of course a perfect right, if so inclined, to reduce *Potentilla Breweri* to *P. Plattensis*, but why not call it var. *Breweri* instead of var. *leucophylla*, more especially as *leucophylla* has been used in the genus already several times. *Potentilla ambigens* and *P. scopulorum* are perhaps of that genus, though experience has shown that it is not always safe to assume even that degree of accuracy on the author's part, and there is hardly anything in the descriptions to prove that he is not describing forms of, *Barbarea vul-*

*garis*, for instance. No information is "vouchsafed" as to whether the plants are annual, biennial, or perennial; both species are said to have "about 5 pairs of leaflets," but whether scattered on long petioles or crowded near the top of them is left to the imagination along with such unconsidered trifles as stipules, bractlets, petals, stamens, styles, akenes, etc. Absolutely the only mention made of the floral organs is "flowers small, yellow," in one case, and corollas nearly an inch in diameter, pale yellow," in the other!

*Sanicula nemoralis* is, as Mr. Greene remarks, the yellow-flowered form of *S. bipinnatifida*. *Sanicula saxatilis* has been collected at Tehachapi, and is probably not uncommon about rocky summits. It has heretofore been considered a form of *S. tuberosa*. *Sanicula septentrionalis*, described from an immature fragmentary specimen distributed under the name *S. Nevadensis* may easily be that species. Mr. Greene's idea of the great importance of the outline, or degree of dissection of a dissected leaf will scarcely commend itself to botanists who know anything about Umbelliferæ. *Microseris indivisa* is a well-known form of *M. aphantocarpha*. *Senecio Blochmanæ* is of course the entire-leaved form of *S. Douglasii*, already provided with synonyms to spare. *Peucedanum robustum* was sent from the type locality to Coulter & Rose at the time of their revision of the Umbelliferæ. They did not find it to be a new species.

Mr. Jepson's account of the mountain region of Clear Lake is remarkable chiefly for the things he did not observe. All the plants mentioned by him have been in the herbarium of the California Academy of Sciences for nearly ten years. *Streptanthus hesperidis* is *S. Breweri* pure and simple. *Arctostaphylos elegans* is another of the absolutely inexcusable synonyms with which that long-suffering genus is becoming loaded. *Gnaphalium bicolor* is so imperfectly described that even the section to which it belongs can only be conjectured from the remark that it can readily be distinguished from *G. leucocephalum*. It is probably only a rather broader-leaved form of that species which belongs to the division "leaves obviously adnate-decurrent, the upper face at least becoming naked and green in age, and with the stem glandular-pubescent or glandular viscid; herbage strongly balsamic-scented; root lignescent-perennial."

Apparently the best species, and certainly the best described is *Collinsia Franciscana;* but the description would have been much

improved if the author had given us some idea of the curvature of the throat, the presence or absence of crests. and some indication of the shape of the seeds. As these points are usually attended to in descriptions of Collinsia, their lack leaves few data for comparison. In all species where account is made of the seeds, the ovules should be numbered instead, as they are usually much less variable. It is probably identical with Dr. Kellogg's *C. solitaria*, which was described from the vicinity of Oakland. No type specimen has been found, but the description so far as it goes agrees with the San Francisco plant. The original *C. sparsiflora* was however a coast plant collected a short distance above San Francisco, and before attempting to separate species from it, it would be well to examine the type which is only too likely to be the same as *C. Franciscana.*

In "Notes and News" Mr. Greene takes occasion to sneer at a paper by Professor Coulter and Mr. E. M. Fisher in the November number of the *Botanical Gazette*, on account of the personal names bestowed on the new species. It must be admitted that such names are not in the best taste, but the remarks thereon come with poor grace from the author of *Mädia Rammii*, *Clevelandia Beldingii*, *Potentilla Micheneri*, *Streptanthus Biolettii*, *Bæria Burkei* *Convolvulus Binghamiæ*, *Collomia Rawsoniana*, etc., etc. Perhaps, however, the creator of these names salves his conscience by remembering that they are principally synonyms. K. B.

*Contributions from the Botanical Laboratory of the University of Pennsylvania.* Vol. i, No. 1. Unlike the usual contributions from botanical laboratories, the papers contained in this are largely physiological. They are: A monstrous specimen of *Rudbeckia hirta*, by J. T. Rothrock; Contributions to the history of *Dionæa muscipula*, by J. M. MacFarlane; An abnormal development of the inflorescence of Dionæa, by John W. Harshberger; Mangrove tannin, by H. Trimble; Observations on *Epigæa repens*, by W. P. Wilson; A nascent variety of *Brunella vulgaris*, by J. T. Rothrock; Preliminary observations on movements of the leaves of *Melilotus alba* and other plants, by W. P. Wilson. The volume is enriched with twelve plates.

*Contributions to the Life Histories of Plants.* No. 8. By THOMAS MEEHAN. Extract from Proc, Philadelphia Academy, 1892.

This is another of the interesting papers recording observations, principally on the fertilization of flowers, of which several previous

ones have treated. The plants discussed are *Euphrasia officinalis*; Gaura and Œnothera: the carpellary structure of Nymphæa; the sexual characters of Rhus; *Rubus Chamæmorus*, *Dalibarda repens*; some morphological distinctions in the genera of Ericaceæ; vitality of seeds in *Lysimachia atropurpurea; Campanula rotundifolia; Cornus Canadensis; Aralia hispida; Luzula, campestris, Cakile Americana, Hypericum ellipticum, Trifolium hybridum; Lathyrus maritimus; Lonicera cærulea; Raphanus sativus;* the nature of the verrucæ in some Convolvulaceæ; *Polygonum cilinode; Aster Tatarica.* The observations are of a kind to be readily made by anyone with leisure and access at all hours to living plants, and require no great knowledge of systematic botany, yet they are of great general interest, and more attention to the physiology of plants would attract to their study many now deterred by the somewhat dry details of herbarium work.

*List of Plants of Los Angeles County, California.* By ANSTRUTHER DAVIDSON, M. D. Local lists are always useful even if very incomplete—they stimulate search. The next issue will probably contain a much larger number. There are many in the herbarium of the California Academy of Sciences, from Los Angeles County, not mentioned in this. In Oxytheca, for instance, *O. trilobata* grows at Ravina, and *O. lutea* at Lancaster. *Boisduvalia cleistogama* is probably an error of determination. The rather numerous printer's errors will of course be rectified in subsequent editions.

*Flora Washingtoniensis.* By W. N. SUKSDORF, is a list of the flowering plants and ferns of the State of Washington. These lists are of great service in the study of the distribution of plants. Washington is a highly objectionable name for a State, as it requires always an explanatory phrase to distinguish it from the better-known seat of the general government.

*Contributions from U. S. National Herbarium.* Vol. i, No. vi. i. List of plants collected by C. S. Sheldon and M. A. Carleton in the Indian Territory in 1891. By J. M. Holzinger. ii. Observations on the native plants of Oklahoma Territory and adjacent districts. By M. A. Carleton. Two new species *Ipomæa Carletoni* Holz and *Euphorbia strictior* Holz are described, with plates, and *Euphorbia polyphylla* Engelm is characterized. Many interesting observations on the relationship of allied species and the distribution of plants are scattered through the papers.

*Check List of the Plants of Kansas.* By BERNARD B. SMYTH. Aug., 1892. This is an attempt to give a complete list of the plants of the State with approximate localities. The introduction shows an originality not common in catalogue makers. The author says: "As to nomenclature the compiler simply adopts those names said by common authority to be the correct ones. He is opposed to changes of name in a plant, and prefers a name long-established and well-known to a name which though more correct, is comparatively unknown. Notwithstanding this, exceptions are made, where evidence is indisputable as to priority of some other name as applied to a particular plant. Most noticeable among these is Hicoria instead of Carya, Navarretia for Gilia, Castalia for Nymphæa, and others. . . . Where no name is given the compiler doesn't know who is authority. . . . A few radical changes are made, as the transferring of the order Nymphæaceæ from Exogens to Endogens, these plants showing most clearly endogenous characteristics of structure. Conversely the order Smilacaceæ should be transferred to Exogens, these plants being exogenous when more than herbaceous."

Under the head of "New Species" are included *Erythronium mesochoreum* Knerr, n. sp.; *Cyperus carruthii* Wood, n sp.; *Cyperus spiculatus* Wood, n. sp.; *Setaria perennis* Hall, n. sp. *Sporobolus pilosus* Vasey n. sp.; *Barbula henrici* E. A. Rau, n. sp. All of these "new species," excepting two, are credited at the end of the character to previous places of publication.

## PROCEEDINGS OF SOCIETIES.

CALIFORNIA ACADEMY OF SCIENCES, *November 7, 1892.* President Harkness in the chair.

Donations to the museum were reported from John Carlsen, Gustav Eisen, Carl Precht, Dr. J. G. Cooper, John L. Howard.

*November 21, 1892.* Mr. T. H. Hittell in the chair.

Donations to the museum were received from Willard M. Wood, Miss Lottie Rau, George H. Knight, Sam Hubbard Jr., Overend G. Rose, M. H. Gilson, T. S. Brandegee.

The Librarian reported 104 additions to the library.

Mr. H. W. L. Couperus read a paper on the possibility of the cultivation of coffee within the limits of the United States.

*December 5, 1892.* President Harkness in the chair.

Additions to the museum were reported from Walter H. Levy, Gustav Eisen, William Hooper, W. G. Blunt, John P. West, Compañia Minera y Beneficiadora de la Barranca, Sonora, Mexico.

The Librarian reported eighty-four additions to the library.

A resolution was adopted to the effect that the Academy heartily indorses the proposition to secure an appropriation from the State Legislature that will cover the annual expense of $25,000 to secure a topographical map of the State, the general government consenting to coöperate with the State to the extent of superintending the work, and appropriating a like amount annually.

*December 19, 1892.* President Harkness in the chair.

Additions to museum were reported from Herbert Kellogg, Walter H. Levy, W. E. Steadman, Baron Bœselager, Walter E. Bryant, G. E. Colwell.

Eighty-three additions to the library were reported.

The Nominating Committee presented a report embodying a ticket to be voted at the annual election.

*January 3, 1893.* Annual meeting. President Harkness in the chair.

Additions to the museum were reported from Ed Garner, P. F. Rountree, Dr. Julius Rosenstirn, Wm. F. Nolte, Charles Allison.

The annual reports of the officers and curators were read and ordered filed.

The report of the officers of election was read and the following were declared elected for the ensuing term:

President—H. W. Harkness.

First Vice President—H. H. Behr.

Second Vice President—J. G. Cooper.

Corresponding Secretary—T. S. Brandegee.

Recording Secretary—J. R. Scupham.

Treasurer—L. H. Foote.

Librarian—Carlos Troyer.

Director of Museum—J. Z. Davis.

Trustees—W. C. Burnett, C. F. Crocker, D. E. Hayes, E. J. Molera, George C. Perkins, Adolph Sutro, John Taylor.

*January 16, 1893.* President Harkness in the chair.

Additions to the museum were reported from Charles Allison, W. G. Blunt, Chase Littlejohn, Charles Fuchs.

Mr. W. L. Watts read a paper on the Geological Economics of the Central Valley of California.

CALIFORNIA BOTANICAL CLUB. *November 23, 1892.* Mr. J. M. Hutchings in the chair.

The following were elected to membership: Samuel H. Hammond, Sidney S. Peixotto, Mrs. A. E. Bush, L. C. Cummins, Miss Mary C. Day, Prof. John Dickinson.

Dr. Gustav Eisen read a paper on the figs of Sonora and Lower California.

CALIFORNIA ZOOLOGICAL CLUB. *December 10, 1892.* Vice President Walter E. Bryant in the chair.

The following were elected to membership: Wm. F. Greany, Dr. H. N. Miner, Fred A. Seavey, W. P. Steinbeck, Aurelius Todd, Prof. C. H. Tyler Townsend, F. S. Plimptom, Dr. Clark, J. Burnham, Overend G. Rose, Mrs. E. S. Alexander.

Mr. Walter E. Bryant read a paper on the zoölogy of Baja California.

Mr. Charles A. Keeler called attention to some of the peculiarities of the fauna of Lower California as illustrating certain laws of evolution.

## MISCELLANY.

### THE INVESTIGATIONS OF THE COLLECTIONS OF THE EXPEDITION TO BAJA CALIFORNIA.

The California Academy of Sciences of San Francisco has at various times, during the last five or six years, sent small expeditions to the peninsula of Baja California, for the purpose of exploring and collecting natural history specimens of the higher as well as of the lower classes. Various parts of that hitherto little-known country have been visited during the different expeditions, and much material has been brought together for future study. The result has been that the fauna of Baja California is becoming better known, presenting many features of great interest. The flora of this country has been already minutely described by T. S. Brandegee, who has added a

large number of species and several new genera to those already known, enabling us now to judge with great certainty as regards the geographical distribution of the plants and their connection and descent from neighboring geographical plant districts. New species will of course after this be added to those already described and enumerated, but they will be comparatively few, and the flora of Baja California can now be said to be very completely and comprehensibly known. Of birds and mammals the collections brought home are large and good, and descriptions of some thirteen new rodents will soon be published by W. E. Bryant. They are mostly the results of his trapping during last year's expedition to the Cape region, or the southern extremity of the peninsula, remarkable for its high mountains, beautiful and luxuriant vegetation, tropical climate and isolated position.

The fresh water fishes collected there are in the hands of Prof. Gilbert, of the Stanford University. The collection of reptiles and batrachians is good and when described will undoubtedly contain much of general interest. A large collection of arachnids from the Cape region, collected during the late expedition, is now in the care of Prof. George Marx, of Washington, the acknowledged authority on American spiders. He designates the collection as valuable and interesting. His paper will be well illustrated. A collection of Colembolas and Thysanuras is being worked up by Prof. Harold Schött, a well-known European specialist, who has already described a number of new Colembolas from Upper California, and who has since received a number of new forms both from Upper and Baja California, all of which are to be embodied in one general paper, on the Colembolas and Thysanuras of the Pacific Coast. Dr. Otto Stoll, of Zurich, whose beautiful work on acarides in the *Biologia Centralo Americana* is generally admired, will describe a small collection of acarides, principally from the Cape region. The collection of diptera from Baja California is not large, but it may be counted upon to contain much of interest. It will be described by C. H. Tyler Townsend, a well-known specialist of this class of insects.

The collection of orthoptera has been forwarded to Lawrence Bruner, and a valuable paper from his hand is expected, though his preliminary opinion on the collection has not yet reached us. The coleoptera were well represented with some 500 species, principally

from the Cape region. They are now in the hands of Dr. Horn, of Philadelphia, who will describe the new forms at an early date.

The land shells, some twenty-two species collected during the late expedition to the Cape region, côntain some eight or ten new species, descriptions of which will soon be published by Dr. J. G. Cooper, who has already written upon the subject of Baja California land mollusks. The land and fresh water oligochæta contain a number of new forms, which are being described by Dr. Gustav Eisen, in connection with other Pacific Coast oligochæta. The species found in the Cape region are entirely tropical, and show most relationship with tropical Mexico and Central America.

The fresh water crustaceans, of which many remarkable forms were collected in the clear waters of San Jose River, will be described by Walter Faxon, of Cambridge. G. E.

## NOTES ON THE CLIFF DWELLERS.

In Southwestern Colorado and in Arizona there have recently been extensive explorations of the ruins of a people now extinct, but probably related to the Pueblo Indians at present living in Arizona. The relics found in their houses indicate that they were an agricultural people, and to strengthen this belief remains of ancient reservoirs and aqueducts exist on the mesas above. There, too, are ruins of houses and towers which were probably occupied before defense became necessary and the people fled to the cliffs. The mesa ruins have usually become mounds overgrown with vegetation, but the cliff houses, from their sheltered position, are in a good state of preservation.

It may be interesting to record the uses they made of some of the plants of the region as well as the plants which they cultivated that grow there no more.

Corn, squash, and beans were the chief crops; the walnuts now and then discovered were probably brought from further south with the cotton which has been found on the pod, spun into thread, and woven into cloth. Undoubtedly, they had commerce with their own people further south, or with other tribes, for seashells have been found matted in the hair of the dead, salt most carefully preserved in balls, and for their arrow points, stones not found near by.

The most valuable textile plant was *Yucca baccata*, the fruit of

which most likely served as food. The Utes at the present time dry large quantities cut into strips for winter use. The Yucca fiber was separated into threads, which were twisted into strands varying in thickness according to the purpose for which they were designed. The best sandals were made of the fine thread, woven so as to be ornamented with geometrical designs; for the commoner sandals they used coarser twine, while the coarsest ones are of braided rushes. They depended for warmth upon a fabric made of turkey feathers ingeniously woven with Yucca twine. The long feathers were split and twisted around the Yucca thread, which was then loosely woven into a blanket of feathers soft and warm. The dead are often found with this for the first covering. The skins of deer were used, too, but rarely, probably because of the difficulty of securing them with their poor weapons. They either raised turkeys or the wild ones were abundant, since implements such as awls and needles were made of the bones, and turkey bones blackened with fire are common.

The common rush *Phragmites communis* was used to make a coarse matting, not unlike that which is packed around tea-chests, but woven in different designs. This was used as a second covering for the dead. Willow twigs fastened together something like the slats of Venetian blinds formed the outside cover, the coffin of these prehistoric people. The Yucca fiber, in connection with the common Juncus, was used in making baskets finer than any made by Indians of the present day.

The piñons and cedars are thick on the mesas of this country, and the former furnished an edible nut which the cliff dwellers collected for food. The timbers for their houses were chiefly cedar, as shown by the beams that still form the floors of the upper rooms and the supports of balconies. These beams are curious, pointed at the ends and very jagged from the stone axes used to roughly hack them into shape. Coarse grass with stiff stems, *Oryzopsis cuspidata*, was tied into bundles to make brushes, probably for the hair. The wild tobacco, *Nicotiana attenuata* is common near their homes and in the cañons where their houses stand like statues in their rocky niches the wild fruits are more abundant than elsewhere, leading to the belief that to some extent they were cultivated. A. E.

NOTES ON GAME LAWS, ETC.

Notwithstanding the rain and cold weather of this year Mr. W. O. Emerson reports that Anna humming birds have commenced building in the eucalyptus trees near his house.

The earliest record of the nesting of this species near San Francisco was made by Mr. Ingersoll, who found a nest with two far advanced eggs on January 14; the winter was a more open one than the present.

By the first of March half a dozen or more resident species will have commenced nest building, and the small boy will prepare a box of bran to receive the "collection" which he makes annually, and which is annually destroyed by mice or otherwise. Such pernicious collecting should be discouraged by parents, and might profitably receive some attention from the would-be makers of perfect game laws for California.

Some radical changes are contemplated when the next legislative "tinkering of the game laws" takes place. Like most proposed alterations of the kind there are some good and some injurious. To provide an open season in California for elk, antelope, and mountain sheep is to assist in their total extermination in this State; too many are killed in defiance of the law as it is. The fault is not so much with the law as with the lax enforcement and a deplorable lack of respect for game laws by the public.

Elk are not rare in some places in Southwestern Oregon, and the theory that persecution in that State has resulted in an immigration of elk to California is extremely probable, but no one need suppose that they are spared to any great extent after crossing the boundary line. The law stops the marketing of elk, and in some instances deters parties from hunting for them, but not always. It is not many months since a large expedition, thoroughly equipped, left San Francisco for Northern California, and it was no secret that they were prepared for illegal game.

Every little while some one comes forward with schemes of restocking the State with mammals, birds, and fish, without a thought of what the possible results may be from the introduction of exotic species. There can be no question as to the desirability of at some time introducing new game, but that time will be after the na-

tive species are actually protected, and that time will never come until better enforcement and a more wholesome public respect for game laws is secured. W. E. B.

## NEWS.

Prof. W. R. Dudley, late of Cornell, has taken the chair of systematic botany at Stanford University. With such men as he and Prof. Douglas H. Campbell in charge of the botanical work of Stanford University, where botany is taught according to modern methods, we may expect to have, in time, a body of resident botanists whose entire stock of botanical knowledge is not confined to the posession of a limited terminology and a large capacity for discovering new species that do not exist.

Miss Alice Eastwood, formerly of Denver, Colo., has succeeded Mrs. Katharine Brandegee as curator of the Herbarium of the California Academy of Sciences, and as acting editor of ZOE.

Mr. Oscar T. Baron has temporarily housed his magnificent collection of butterflies and humming birds in the California Academy of Science building, where he spends much of his time arranging and studying. He contemplates this fall an extended trip to Ecuador and the central Andes for the purpose of collecting butterflies and humming birds, his collections in these lines from South and Central America and Mexico being among the richest known.

Mr. W. Otto Emerson, who has been studying art in Europe for the past two years, has returned to his home in Haywards, Cal.

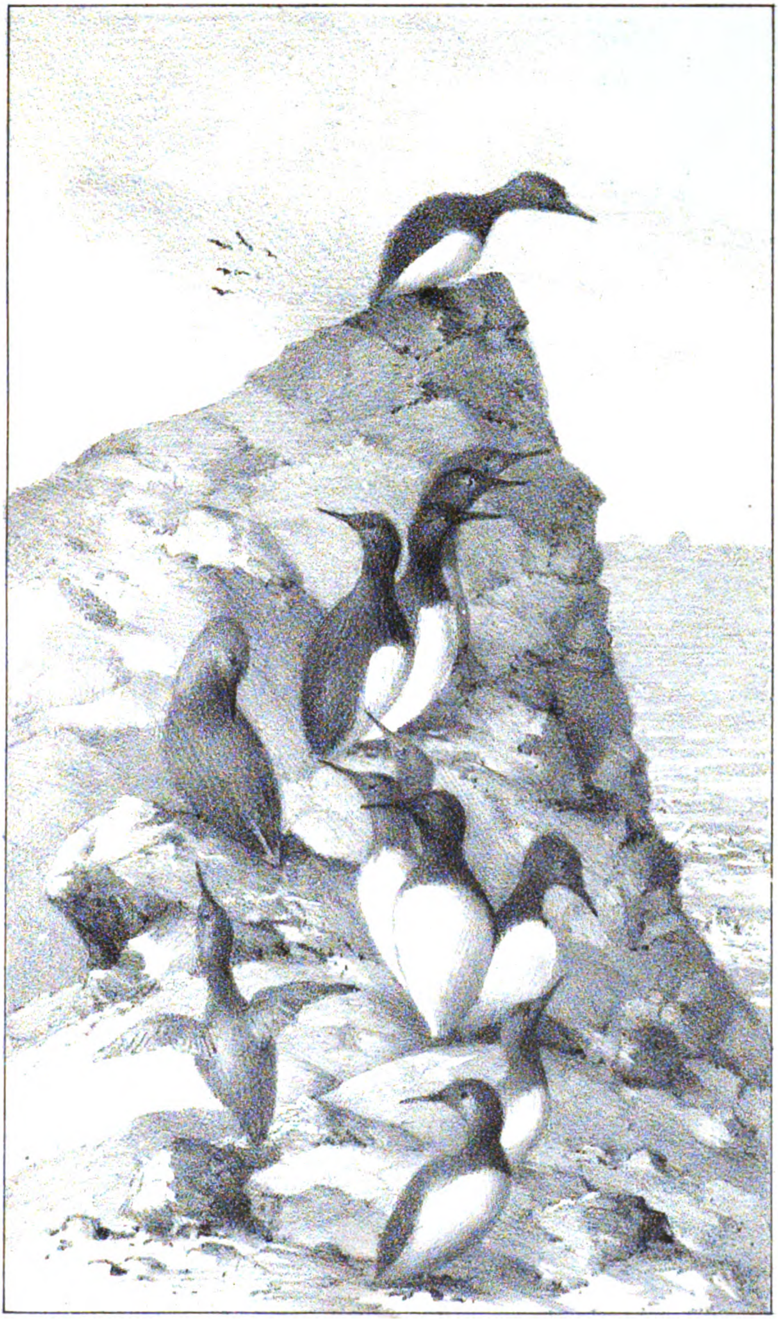
On the 1st of February Mr. Charles A. Keeler sailed for New York on the ship *Charmer*. His latest contribution to science, entitled "Evolution of the Colors of North American Land Birds," forming No. iii of the Occasional Papers of the California Academy of Sciences, has been received too late for review in this issue.

Nine new species of Ocnerodrilus have lately been described by Dr. Gustav Eisen in the Proceedings of the California Academy of Sciences (the memoir not yet published). Two of the species are from the Cape region of Baja California, one from Sonora, Mexico, and the others from Guatemala. Dr. Eisen is now describing the Pacific Coast Oligochæta, and will be glad to receive specimens for examination.

# INDEX.

[Simple lists not indexed.]

PLATE XVIII.



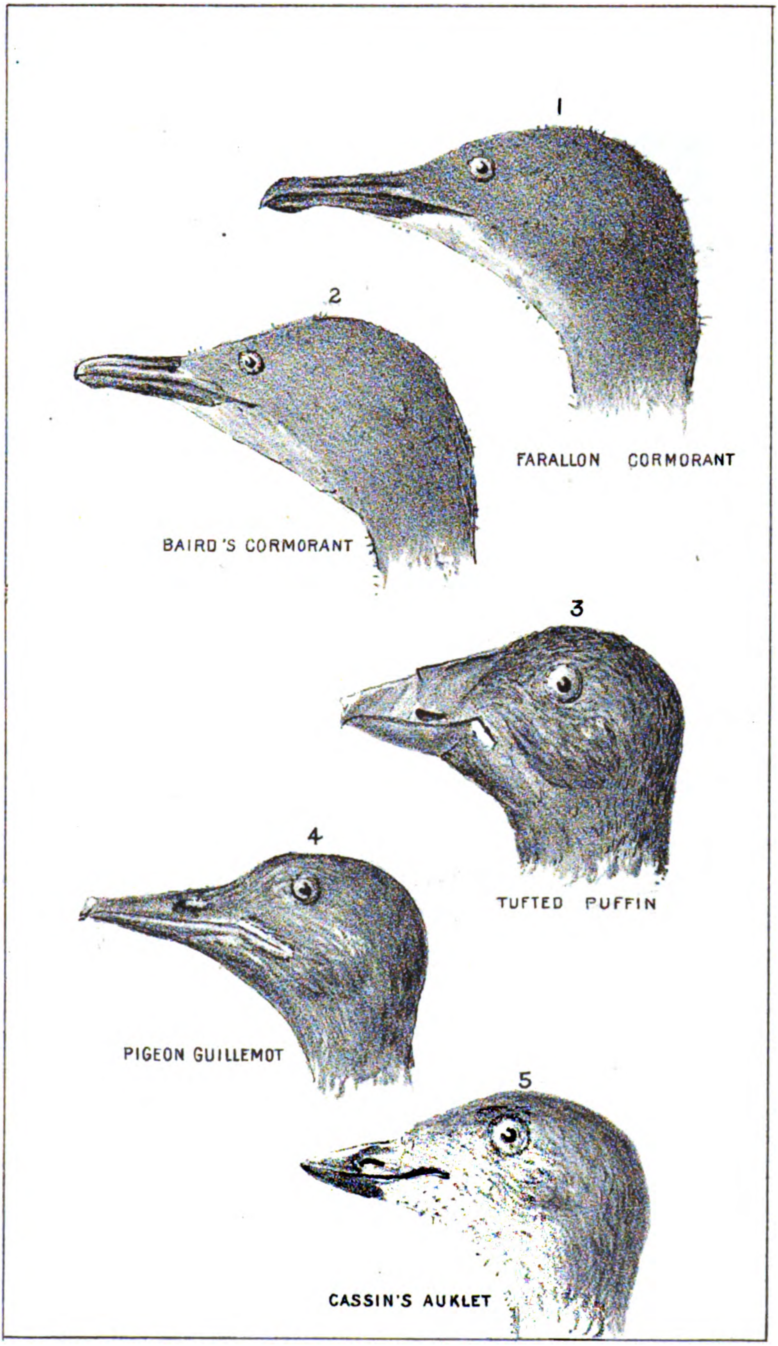
C.A.K.Del.et.Sc.

CALIFORNIA GUILLEMOT

FARALLON CORMORANT

PIGEON GUILLEMOT

PLATE XXI.

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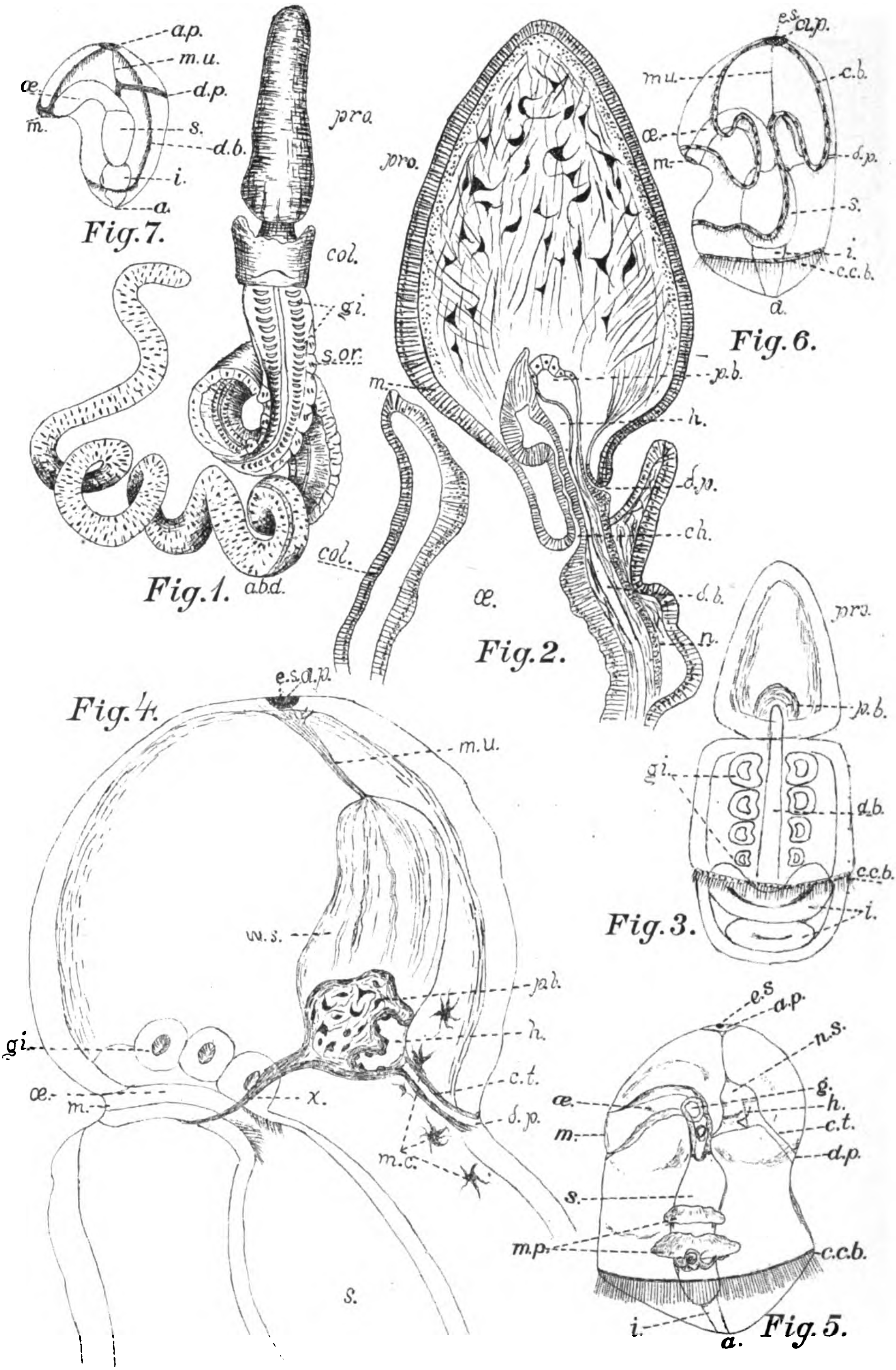


BALANOGLOSSUS.


RUMFORDIA CONNATA

PLATE XXIV.


EPILOBIUM NIVIUM

# ZOE

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CONTENTS.



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